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The Journal of Comparative Medicine and Surgery

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ORIGINAL COMMUNICATIONS.

ART. I.—THE COMPARATIVE ANATOMY OF THE PYRAMID TRACT.

BY E. C. SPITZKA, M.D., NEW YORK.

INTRODUCTORY REMARKS.

The physiological structure of the brain is characterized by the union of two forms of nerve tissue: the *ganglionic* and the *conducting*. The former is the active agent in the reception, registration and association of impressions, as well as the evolution and co-ordination of movements; the latter plays the more passive part of a pathway conveying impressions *to*, or impulses *from* the ganglionic substance. It is the termination of the conducting paths, that constitutes the most accurate test of the functional assignments which are being made to the ganglionic brain centres, of which so large a number have been determined by a combination of anatomical, physiological and pathological methods. The mere knowledge of the names and situations of eminences and depressions of the brain surface is as unprofitable as would be the inspection of the outside of a clock-case to one desirous of understanding the mechanism by which the hands move round the dial. It is the deep structure of the various segments comprising the cerebral mechanism which is of importance to the physician, for in its disturbance the intrinsic features of cerebral symptomatology are to be found.

Physiologically speaking, the brain when separated from its peripheral connections is inert. It is by virtue of efferent and afferent nerve-tracks establishing, as they do, connections with other parts of the body, that the brain becomes the organ of sensorial reception, the seat of automatic and volitional co-ordination, and through these, in turn, the laboratory of the mind. Every intelligent study of the brain must start from this fundamental fact, and it is therefore the task of the anatomist to unravel the paths by which functional impulses travel *to* and *from* the various centres included in the brain. Thus, if the fact be established that a given nerve bundle is connected with the cells related to the anterior roots of the spinal nerves—which, as we know, lead to muscles—it is to be inferred that the gray matter in which such a bundle originates must have a functional relation to motor action. Again, if one end of a nerve-bundle can be traced to the optic nerve, it is reasonably certain that it conveys visual impressions, and that the gray matter with which its other extremity is united must be a visual centre.

The means employed by modern investigators to disentangle the great labyrinth of nerve-tracts in the brain and spinal cord are the following:

I.—The direct examination of nerve-tracts with the naked eye. This method, followed by Gall, Reil, and recently improved by Stilling, the younger,* depends on the tendency of brain tissue, hardened in alcohol, when torn asunder, to break in the direction of the fibre-tracts running through it. Although admirably adapted to illustrate salient features to beginners, little dependence is placed by modern authorities on this method.

II.—The demonstration in microscopic sections of the connections of individual nerve fibres with nerve cells. In properly prepared specimens, the so-called axis cylinder processes of ganglion or nerve cells, may be traced into medullated nerve fibres. In this way the connection of the pyramidal cells of the cortex with the fibres of the corona radiata is readily shown. But what we chiefly owe to this method is the knowledge of the so-called cranial nerve nuclei: small accumulations of nerve-cells at or near the floor of the fourth ventricle, into which Stilling the elder, Meynert, Deiters, Dean, Duval and Clarke traced the roots of the last nine cranial nerves.

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* The method of defibrillating brains hardened in alcohol, inaugurated by Gall, and cultivated by Foville, Arnold and Meynert, had, until recently, fallen into disuse. It is certainly well calculated to exhibit the coarse nerve strands in the hemispheres, and even such compact bundles as those of the pyramid tract, where it courses through the pons. Some of the earlier notions about the lemniscus (Reil) were quite correct, though based on this coarse method. Stilling, the younger (Investigations on the Structure of the Optic Central Organs. Part 1: Chiasma and Tractus Opticus. Kassel and Berlin: 1882) claims that the objections urged against the use of this method no longer exist, as the fine sections made by the improved microtomes of to-day, which were not at the disposal of earlier investigators, may

III.—The comparison of the relative development of nerve-tracts and centres in animals having peculiar physiological characters. As the development of an organ increases with its function, it is fair to assume that the centres and tracts devoted to a special function will vary with the importance of that function in special animals. Numerous and important facts have been established through a comparative study of the mammalia. The mole, for example, has rudimentary eyes, the consequence is that the anterior pair of the corpora quadrigemina with the connected optic tracts, are also rudimentary. The elephant has a powerful trunk, subservient to a remarkable extent to his intellectual needs; in harmony with this fact, his facial nerve and nucleus which control its motions are unusually large. The bat has overgrown anterior extremities, which are developed into large and powerful wings; correspondingly, the cervical swelling of the cord is very large, while the lumbar swelling is comparatively as insignificant as the hind extremities of the bat are diminutive. In the kangaroo, on the other hand, where the relative preponderance of the extremities is reversed, the relations of the cord swellings is the opposite: the lumbar swelling far exceeds the cervical swelling, just as the hind extremities exceed the anterior. In most cases, where a careful examination has

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be used as topographical and histological guages. One advantage of the defibrillation method is that it exposes nerve-bundles in their continuity, follows all their undulations, and thus furnishes a plastic conception of their relations in space, which is very difficult to obtain from a study of sections. Identical considerations had been advanced several years before by the author ("Contributions to Encephalic Anatomy. Chicago Journal of Nervous and Mental Diseases.")

Stilling has suggested some refinements of *technique* which, if they accomplish all he claims, are destined to revolutionize the methods now in vogue. For the present his method as well as his published results must be regarded as *sub judice*.

been made, such physiological atrophies and hypertrophies of special peripheral organs have been found to be accompanied by corresponding enlargement or shrinkage of the related nerve roots and nerve nuclei. The comparative method thus constitutes a valuable criterion of the physiological bearing of structural peculiarities.*

IV.—The observation of the course followed by that secondary degeneration which ensues after the destruction of nerve centres, or the interruption of nerve tracts. When disease destroys ganglionic tissue, or interrupts the physiological connection of a ganglion with its naturally associated end organ, the nerve tract connected with the diseased or atrophied ganglion, degenerates.† The precise position of that nerve tract is easily determined by the change in color and consistency which it exhibits. This is the most reliable and valuable method of studying the course of nerve tracts.

In case the animal in whom disease or injury of the brain occurs, be very young, the affected nerve tract is not merely changed in color and consistency, but it may fail to be developed, or having developed, disappear entirely. Thus, by destroying the so-called motor zone of a newly-born cat or dog, the pyramid tract is found to be absent. On extirpating the eye of another, that part of the brain which is connected with the sense of sight remains undeveloped or undergoes shrinkage. We are enabled by this method, which is known as the "atrophy method," to artificially arrest the development of special centres in the brain and cord. Nature, however, often effects the same purpose. Animals are born with an eye or a limb absent; correspondingly the nerves, normally

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* Exclusive reliance on the comparative method might lead to grave errors. In general zoölogy it would be faulty to argue from the external resemblances of animals that they are related forms, and many popular errors are due to this fallacious manner of viewing things. The whale is a fish—the bat, a bird—the armadillo, a tortoise—the snake, a worm, according to this. Similar errors are due to the superficial study of surface resemblances of the brain. Already one of the ancient writers argued that the brain could not be the seat of the mind, because the ass had as well convoluted a brain as man.

Only related forms should be compared. It happens that, with the possible exception of the elephant, the porpoise is the only animal—besides man and the monkey—in whom the island of Reil is completely covered. Now, the island of Reil is in man, with its environs related to the function of speech. Would it then be just to argue that the porpoise had a high potential of speech faculty? No. The development of gyri in the porpoise's island, and its concealment from view, are evidences of nearly as high, if not equally connected with such parts, are absent, and the nerve tracts and centres in the brain which represent their functional activity, are equally wanting. Waller, Türck, Bouchard, Charcot, v. Mannkopf, Meyer, Homen and v. Monakow have contributed to the knowledge of nerve tracts in the human brain by these various methods, while their course in lower animals has been elucidated chiefly by v. Gudden and his pupils. The first researches of this nature in this country were made by the writer.

V.—The study of the progressive development of nerve tracts in fœtal and young animals. Foville and Meynert discovered that certain nerve tracts in the brain and cord, which are originally equally gray, become white in color (through the acquisition of myeline) at definite periods of fœtal life. It thus becomes possible to distinguish them by this chronological difference in development. But such observations were disconnected and fragmentary prior to Flechsig's researches. It was shown by this author that the study of the myelinic maturation of nerve tracts was destined to clear up the labyrinth of intra-cerebral and spinal nerve tracts far more extensively than all other methods used up to the time of the appearance of his great work.

In the case of several of the better-known brain tracts, the extent to which the various methods confirm each other is striking. They not only sustain each other, but are in accord with the results of empirical physiology and pathology. Thus it is established that the electrical irritation of certain fields of the brain-surface provokes movements of the face and extremities on the opposite side of the body. If now these same fields be destroyed the animal is found to have lost the

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high brain development *in general*. In man, the island is high (dorso-ventrad) in front, and tapers backwards ; in the porpoise it is the reverse ; it shows its greatest height near the auditory field, which preponderates in the Cetacæ, who have the finest hearing faculty and the largest auditory nerve in the animal kingdom.

In this connection I desire to express my concurrence in a statement made by Wilder before the American Neurological Association. I had stated that the porpoises' island was as large as the human. Wilder finds that in absolute linear dimensions this is true, but that as the human island is very convex and the porpoise's. flat, the surface area in the former may be greater. At the same time, the statement that the porpoise has the most numerous gyri remains unchallenged.

† While it is generally supposed that nerve-tracts degenerate in the direction of the functional impulses which pass through them, there are some remarkable exceptions to the rule that motor-tracts degenerate in a centrifugal and sensory tracts in a centripetal direction.

power over the same parts. Examining the brain, months after the removal of the motor field, it is found that a tract of fibres in the white substance has undergone secondary degeneration, and can be traced by the ensuing color change through the *crus*, *pons* and *oblongata* of the same side, then across, *via* the decussation of the pyramids to the opposite side of the spinal cord. On comparing the brains of young and fœtal animals of the same species it is found that this very tract obtains the white color indicating maturity at a special period. Defective development of the motor region is accompanied by a defective condition or absence of the same tract, and it is possible to produce—create, we were about to say—an animal lacking the pyramid-tract of one side by destroying the corresponding motor province of the cerebral cortex in early life.

If further evidence were wanting to demonstrate the functional and morphological position of the will tract, comparative anatomy would furnish it; just as the cerebral hemispheres preponderate in man, so the pyramid tract is more voluminous in him than in any other animal. On comparing a series of animals, beginning with the marsupials, we find that just as the cerebral hemispheres appear larger as we pass from the lower to higher forms, so the internal capsule becomes more distinct, the contour of the *pes pedunculi* bolder, the pyramids more salient, while the area of the posterior division of the lateral columns, into which the latter decussate, is increased. These anatomical and physiological facts harmonize so completely that we cannot do better than commence our analysis of the cerebral mechanism with that important and clearly understood set of centres and fibre tracts which are concerned in the central regulation of voluntary motion.

As the higher centres of motion are located in the cerebral cortex, and the lower centres are arrayed in a nuclear series extending from the aqueduct down to the terminal cone of the cord, while the connecting tracts occupy important positions in almost every segment of the nervous axis, we shall throw a rapid glance at the morphology of the brain and cord as a preliminary.

The central nervous system precedes all other organs of the body in development. It is the first permanent structure indicated in the mammalian germ, in whose shield-shaped area (Fig. 1) it occupies a dorso-axial position, to be retained ever after in the maturing body. The cells of the germ which are the products of the yolk-cleavage following fertilization, are closely crowded in the median part of the upper of the three layers (Fig. 2) of which the germ consists. They present to the eye an opaque appearance, like a streak extending from the head-end to the tail-end of the otherwise transparent *area* of the embryo. This streak, known as the medullary lamina, is the first trace of the brain and cord.

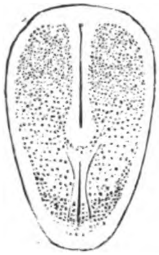

FIG. 1.

Area Embryonica of rabbit The upper streak is the medullary lamina, the disappearing primitive streak, which is a temporary structure, and vanishes as the medullary streak is developed, is indicated at the narrower or caudal end of the shield. As the specimen was drawn by reflected light, the thicker part of the germ, both on its margin and in the axial structures, is indicated by clear spaces.

The cells of the medullary lamina continue to preponderate in growth, and soon those at the edges rise, including between them a depression, concave from side to side, and known as the medullary furrow. As its edges continue rising they approach, and finally coalesce, completing the closure of the furrow, into a medullary canal. The process by which the flat lamina become furrowed, and then converted into a tube may be compared to the rolling up of a strip of tin to form a pipe.

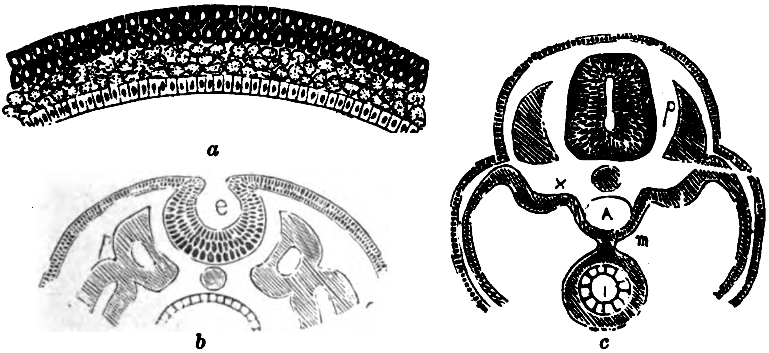

Fig. 2.

Diagrammatic trans-sections to illustrate the three super-imposed cell layers of an early germ, and their foldings in three successive stages: (e) medullary groove, closed in the third stage represented, to form the central canal of the cord.

The medullary tube, whose surrounding wall is to form the solid tissues of the brain and cord, while the lumen within is to constitute their natural cavities, is at this stage of nearly uniform calibre. An enlargement is noted at the head end (Figs. 3, 4, 5, 6) which indicates the location of the future brain.

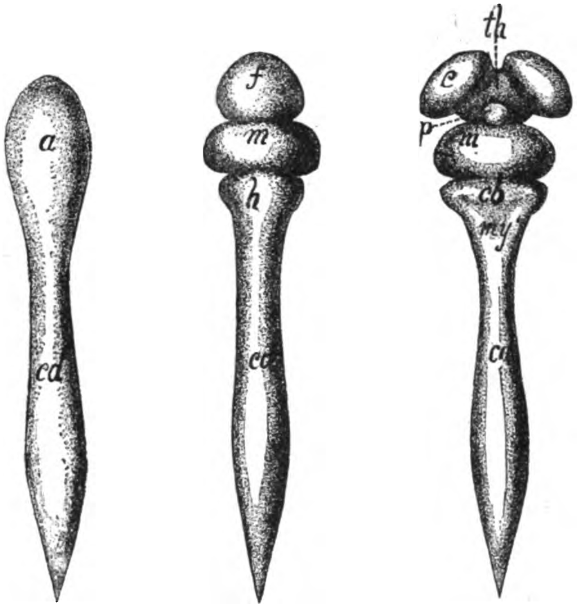

Fig. 3. Fig. 4. Fig. 5.

Diagrammatic representations of three successive stages in cerebro spinal segmentation.

The brain portion outstrips the cord portion in growth, and early exhibits two constrictions imperfectly separating it into three globular sub-divisions: the primitive vesicles of the brain (Fig. 4). Each of these vesicles contains a dilated subdivision of the medullary canal communicating with the others through narrow orifices, which correspond to the abovementioned constrictions; these cavities are the primitive cerebral ventricles (Fig. 7). In the order in which they lie, the vesicles are spoken of as the fore-brain, mid-brain and hind-brain. The latter is continuous with the cord, which remains the longest, but also the narrowest segment of the central nervous system. The cavity of the cord becomes narrowed to almost capillary dimensions, and is known as its central canal. The cavity of the hind-brain becomes the fourth ventricle, that of the mid-brain becomes a narrow passage connecting the fourth ventricle with the cavity of the fore-brain, and is hence known as the aqueduct. At first the mid-brain is the most prominent of the brain vesicles, but remaining comparatively stationary, thereafter is outstripped in development by the fore and hind brain, which undergo modellings, resulting in the formation of the most massive of the brain divisions.

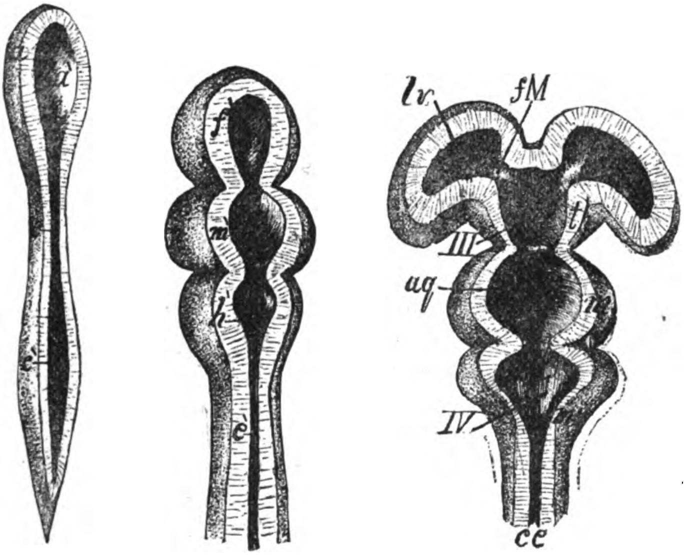

Fig. 6. **Fig. 7.** **Fig. 8.**

Diagrammatic representations of the same stages shown in the preceding figures, the dorsal walls being sliced away to expose the ventricular cavities.

The fore-brain exhibits a slight indication of a division into an anterior and posterior segment. The anterior is composed of two symmetrical parts, each of which seems as if it were a side-bud attached to the posterior, unpaired division of the fore-brain. These buds are the cerebral hemispheres (Fig. 6), They are hollow; the cavity of each is known as a lateral ventricle, and communicates, through the *Porta monroi*, with the cavity of the unsegmented or "parent" part of the fore-brain (Fig. 8). After the separation of the cerebral hemispheres, with their contained lateral ventricles, the cavity of the parent part is named the third ventricle.

The roof of the fourth ventricle undergoes a thinning out in nearly its entire extent. The most anterior portion constitutes an exception, and becomes greatly enlarged, forming a sort of ledge behind the mid-brain, which is the rudiment of the cerebellum (Fig. 6).

After the formation of the cerebral hemispheres, and the cerebellar rudiment, the brain of the mammalian embryo resembles that of the adult reptile. The hemispheres are so small that they fail to cover the other segments. The mid-brain in both consists of two rounded eminences: the optic lobes. The cerebellum is a simple fringe or cap, covering the anterior part of the fourth ventricle. The resemblance is still more striking in minute details. The chief difference lies in the relative development of the olfactory lobes. In both cases these are hollow extensions proceeding from the cerebral hemispheres, but they are much larger in the reptile, and attached to the front of the cerebrum, while in mammals the insertion is nearer to, or at the base. There is also a great difference in the direction of the encephalic axis. In reptiles, it is comparatively straight (Fig. 9), there is but little deviation of a line drawn along the base of the brain, from the horizontal. In mammals, this deviation is considerable (Fig. 10), greater in the highre than in the lower forms and greatest of all in man. One of these deviations is a little above (cephalad of) the foramen magnum, at about the junction of the spinal cord, and the medulla oblongata. The concavity of this curve is directed towards the base of the brain. The brains of most adult mammals exhibit a marked impression, running transversely on the basilar-face of the oblongata, which I propose to designate the *basilar bend.* It has never, to my knowledge, been referred to, and never been named, but it is clearly in many figures of the embryonic human brain, and in Figure 2 of Plate 1, of Wilder's monograph on the "Brain of the Cat."

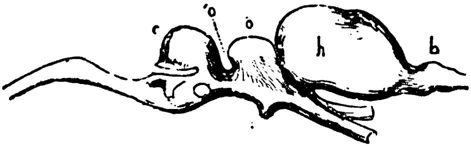

Fig. 9.

Lateral view of brain of Logger-head Turtle. (*Thalassochelys Caouana*).

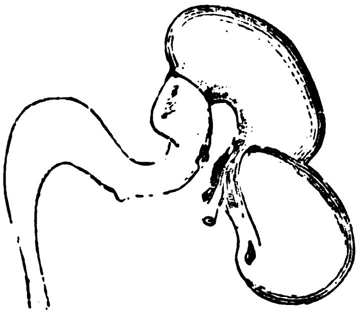

Fig. 10.

Lateral view of brain of embryonal dog.

The next deviation is in the region where the Pons is to develop. Its convexity rests on the floor of the skull. It does not interest us here. The third, and main, deviation is, as it were, a reaction from the Pons curve, and is in the opposite direction. It is due to its greater extent in mammals, and its lesser extent in birds, that in the latter, the cerebral hemispheres, when developing, do not over-lap the mid-brain (optic lobes), but push their way between them to come in direct contact with the cerebellum. In this way the optic lobes become crowded to one side, and eventually lie at the base of the bird's brain, a position which they occupy in no other amniote vetebrate.

In the mammalia the cerebral hemispheres gradually overlap the other segments of the brain. It is exactly as if the parent part of the fore-brain, the mid-brain and hind-brain constituted a stalk, to one end of which (the fore-brain) two buds (the cerebral rudiments) were attached. The buds, however, grow and grow, till they press against each other, and then, gradually swelling out backwards, eventually hide the stalk from view (Fig. 11). The concealment of the various

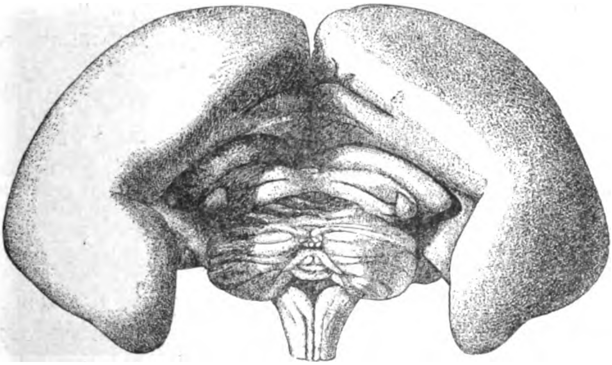

Fig. 11.

Brain of fœtus, the callosum divided, and hemispheres separated to show the stem (axis).

segments is not, however complete in all forms. In the marsupials (opossum) hedgehog, and small bats—the mid-brain is uncovered; in some rodents (hystrix) the cerebellum is entirely uncovered; in the carnivora, the cerebellum is partially uncovered, being most concealed in the following order, which closely corresponds to the grade of cerebral development: fox, cat, dog, coatimundi. bear,. sea-lion. A similar series can be constructed of the agglomerated proboscidea, artiodactyla, perissodactyla and cetacea: hippopotamus, horse, sheep, deer, ox, pig, elephant, porpoise. In the monkey tribe alone (including man) is the entire brain axis, with its cerebellar outgrowth covered by the overgrown cerebral hemispheres, so that looking from above only the latter are seen. The lowest forms, however: the prosimiae, such as the lemurs, have the cerebellum partly uncovered. The following genera have been examined by the writer, and found to correspond to man in this regard: hapale, nyctipithecus, cebus, ateles, cercopithecus semnopithecus (*maurus* and *entellus*), cynocephalus (*babouin, olivaceus* and *porcarius*), macacus (*radiatus* and *cynomolgus*), troglodytes (*niger*), and simia (*orang*).

The overgrowth of the cerebral hemispheres may be regarded as an *index* of the domination of the higher nervous co-ordinations known as mind, intellect, etc,, over the reflex and automatic centres situated in the cerebro-spinal axis, and extending from the thalamus to the conus terminalis. The controlling influence is exerted through nerve bundles, which connect the hemispheres with the lower ganglia. The best parallel that can be used to illustrate this important relation of the *controlling* higher centres to the *controlled* inferior centres is that of a well-generaled army operating in the field against a foe: a parallel which is strengthened by the fact that the nervous mechanism is all-important in that contest for existence in which every healthy organism participates. The outer world is stored with inimical influences, on the one hand, and with the objects which the animal requires for its support, on the other. The inimical influences must be avoided if they operate on a weak point, skillfully and energetically repelled, if they cannot be avoided, and the useful appropriated on the line of march through life. The desirable, as well as the inimical influences are recognized by the peripheral end organs of sensation, the attacks of the foe are met by the motor apparatus. The latter is also exerted in obtaining the needful.

In this parallel, the peripheral organs of sensation obviously play the part of *vedettes* who communicate with the reflex battalion chiefs or the nerve nuclei of the spinal cord and brain axis. If the former discover movements of the foe, the battalion chief, through his adjutant (the motor nerve) may hurl his forces (the motor-end organs) at the foe, or withdraw them. In a close attack, indeed, he has no other alternative than those "reflex acts." But as there are a large number of battalions and squadrons in the army who require united management, a field-marshal is present (the imperial cerebrum) who is informed by fleet couriers and field telegraph (the centripetal fibre system) of the reports which each battalion chief receives; who is, from his central position, able to compare and combine the impressions received along the whole line (that is, those coming from *all* the sensory organs in the aggregate) and then intelligently directs advance and retrograde movement by signals (through the centifugal fibre-tracts). Thus the battalions may be deployed most advantageously, retreating before threatening attacks, whose extent their own vision is of too limited a range to discover, avoiding ambuscades and striking the foe at the weaker points unmasked by their comrades. The eye may see a distant danger which the skin does not feel, and the ear places the brain on guard against a foe coming from some other direction than that covered by the eyes.

It would be manifestly incorrect in this parallel to attribute the exclusive credit for a successful movement, or the blame of a failure, to the field-marshal. If the *vedettes* do their duty; if the battalion chiefs properly transmit their information; if the signals are not interfered with, and the battalions are well disciplined and brave—that is, if the sensory end organs are healthy, the reflex arches, and the conducting tracts uninterrupted, and the muscles under control—intelligent orders given by the commander-in-chief will be properly executed. But if the *vedettes* are asleep, the army may be surprised, or if the messages to or from headquarters are interrupted, the threat, ened detachment may be destroyed without the field marshal's knowledge or responsibility. Thus, the hand may be severely burned without the conscious knowledge of the brain, if the nerves of the brachial flexus be divided, if the cervical enlargement of the cord be destroyed, or if the sensory impressions coursing in the internal capsule be intercepted by hemorrhage, softening, or tumors. Just as the battalion chief is a necessary, though humble, agent in the movement of an army, so the reflex centres are essential to the acquirement and execution of functions on the part of the higher centres.

From the foregoing, it is evident that the centres for the individual functions of the periphery are multiple, and differ as to grade; there are centres of lower, higher and, in some cases, of intermediate physiological dignity. In the case of the muscles which move the eye-balls, there is one set of centres for each of the individual muscles in the "nuclei," situated near the Aqueduct of Sylvius, and the neighboring ventricle cavities; there is a higher centre in the optic lobes, which coordinates these individual muscle centres, in *unconscious* union, subservient to retinal impressions; and this automatic mechanism is in its turn under the dominion of a cortical area in the organ of intelligence, which employs it in the *conscious* direction of the eyes to objects in which an intelligent interest is taken. In this and analogous mechanisms, the various centres connected with a common periphal organ are not strictly independent of each other. The higher centres utilizes the channels and energies of the lower. Thus, the reflex, the automatic and the intelligent impulses to movements of the eye all pass through one and the same oculomotor, abducens, and trochlearis nerves, and one and the same nuclear connections of the nerves.

With these preliminary observations we are prepared to examine the comparative development of the pyramid tract in different species of animals.

I.—SURFACE RELATIONS.

The term *Pyramids** is given to two symmetrical eminences of the ventral (*inferior*) face of the brain. They extend from the caudal (posterior) border of the *Pons* to the bend* of the *oblongata.* Up to the present day, the greatest confusion prevails among comparative anatomists regarding the relations of these bodies in the lower mammalia. The fact, that in man the columnar eminences of the pyramids enclose between them the ventral fissure of the oblongata, has determined the designation of every eminence in any mammal, bordering on this fissure, as a pyramid. This superficial procedure has led to the attributing large and well developed pyramid tracts to the very animals which have not the slightest, or at best, but rudimentary traces of them. To-day we are not content with deducing analogies from mere surface resemblances, and inasmuch as the pyramids of the human brain represent the surface development of a part of the centrifugal course of that nerve tract which mediates the voluntary movements of the extremities, it behooves us to be careful how we attribute well-developed pyramid tracts to animals who have corresponding eminences, but who have atrophic or rudimentary extremities.† But even a consistent and critical surface study of the oblongata would have sufficed to establish one of the most interesting criteria of the zoölogical position of certain mammalian groups. To deserve the designation pyramids on the ground of resemblance to the corresponding columns of the human brain, the following conditions must be complied with (Fig. 1):

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* They were sometimes designated as *anterior* pyramids, in contradistinction to the slender columns of Goll, which were termed posterior pyramids. The latter term being now abandoned, the prefix is unnecessary.

1st. They must be columnar.

2d. They must appear to emerge from the substance of the Pons.

3d. They must lie entirely ventrad of the *trapezium.*

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* This is a characteristic feature of the oblongata, and a remnant of one of the embryonal curves. Although not designated by any special name, it has undoubtedly been noted by many observers. Wilder figures it very early and accurately in his lithographic plates of the cat's brain (Anatomical Techology.) It is most distinct in those mammals in whom there is an abrupt decrease in the dimensions of the oblongata towards the cord, such as the bat, rodentia, artiodactyla, in lesser degree, the zona-placentalia, and least of all, in adult man. In the human embryo it is very well marked, and probably the acuteness of the inflection is not an unimportant factor in the causation of the decussation of the pyramids.

† See the reference to Serre's argument in the sequel.

4th. They must, if there be visible olivary eminences, lie mesad (within) of the latter.

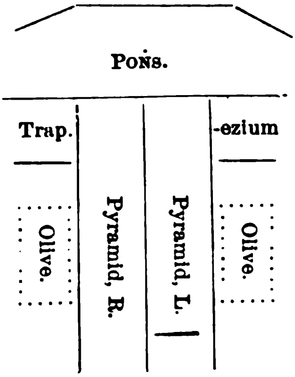

Fig. 12.

As far as such columns can be distinguished in mammalian brains, those of all the zonaplacentalia, the anthropomopha artiodactyla, and several other groups to be spoken of comply with these conditions. In the proboscidea as well as the cetacea, there are no bodies which comply with even one of them. No columns are seen bordering the ventral or basilar fissure, which emerge from the Pons. A transverse section through the caudal half of the latter shows that it is made up of gray substance and transverse bundles exclusively. No sagittal fibres exist. It is true that both in the porpoise two symmetrical eminences enclosing the median sulcus* are found situated a short distance behind the caudal border of the Pons. But these eminences have the following distinctive characters:

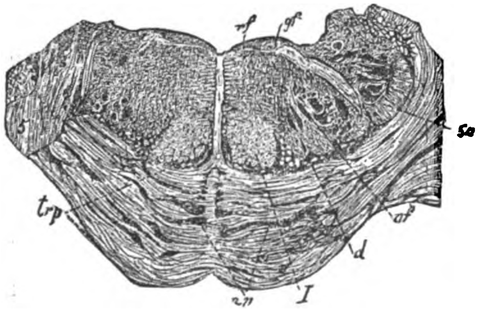

Fig. 13.

Trans-section of Pons Varolii of elephant, showing absence of sagittal (pyramid) fibres in Pons.

1st. They are not columnar, but oval, being distinctly rounded in front and behind.

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* This is not a deep fissure, as in some animals.

2d. They do not appear to emerge from the substance of the Pons; there is a deep trench * between them and the latter; microscopic sections reveal the absence of any corresponding continuation in the substance of the pons proper.

3d. The trapezium not being exposed in the elephant or porpoise, does not come in contact with these bodies, inasmuch as they have no relation with the concealing ledge of the Pons.

4th. Microscopic section shows these bodies to be the *true* olivary nuclei.† It is the absence of the pyramids that accounts for the coming in contact of the olivary eminences, just as in human monstrosities where the pyramid tracts are absent, the olives become entirely exposed, and lie together on both sides of the basilar fissure. (Rohon.)

From the above, then, the following proposition ‡ may be advanced:

The Proboscidea and Cetacea are characterized by the absence of pyramids in the oblongata, and the consequent exposure and mutual approach of the olivary eminences.

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* This is most marked in the elephant.

† Meynert remarks ("Klinik der Krankheiten des Vorderhirnes,' p. 27): "The olives of the aquatic mammalia were already known to Stannius." It is everywhere evident throughout Meynert's writings that he has utterly failed to appreciate the fundamental distinction between the *phocidæ* and the *cetacea*, and confounded them under the common designation "aquatic mammals." Burdach, in 1819, discriminated, he says: "Only with dolphins, seals and apes are they (the olives) more developed. Still much less so than in man." He seems to rely on Stannius, Treviranus, Carus and Tiedemann for the substance of this statement.

‡ The discovery that these animals have no pyramid tract was made by Spitzka, and announced, as far as the elephant is concerned, in the following papers: "The Sensory Tract of the Fore-Brain"—*Chicago Medical Review*, July 5th, 1881. "A Contribution to the Morbid Anatomy of Pons Lesions" *American Journal of Neurology*, Nov., 1883. The condition of the parts in the porpoise, while referred to in earlier communications, was first distinctly asserted in "Contributions to the Anatomy of the Lemniscus,"—*N. Y. Medical Record*, Oct., 1884. It is singular that this should not have been noticed before, and the more so as it must have been difficult for Stannius and other older observers to recognize the large size of the ordinary eminences, without, at the same time, noting the absence of the pyramids in the porpoise. Even the accurate and painstaking Lockhart Clarke speaks of the "pyramids" of both animals, but he does this rather on the strength of the statements of others.

This adds another ground to the numerous reasons[*] advanced for classifying the Cetacea near the old group of the Pachydermata, represented in modern classification by the proboscidea, perissodactyla, and non-ruminant artiodactyla with the possible inclusion of the sirenia.

But aside from the signification of this proposition to the zoologist, it furnishes much food for reflection to the physiologist; it does away with the dictum of Meynert that the development of the pyramids is one of the indices of cerebral, *i.e.*, intellectual development.[†] Large pyramids do not signify a large cerebrum, and small pyramids a small cerebrum. The elephant and porpoise have both far more richly convoluted brains than man. Whatever guage of cerebral *status* be applied, they will be found to occupy a very high position. They approach the anthropomorphæ in the almost complete concealment of the cerebellum (porpoise), in the complete concealment of a large, well-convoluted Island of Reil, in the surface dimensions of the Pons, and in the presence of a posterior ventricular horn, as well as in numerous other coarse and histological features. Their intelligence is of a high order.[‡]

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[*] Beauregard ("Recherches sur le Cerveau de Balænoptera Sibaldii; Société de Biologie Communiquée le 10ieme Fevr., 1883), finds remarkable analogies between the gyral type of the whale and the horse, and calls attention in this connection to the fact that the urogenital apparatus, as well as the placental relations of both groups exhibit a close relationship.

[†] This dictum was originally, I think, advanced by Gall, and with the limitations to be suggested, has some force. Even so old a writer as Burdach hesitated to accept it unreservedly, while Lockhart Clarke appears more prepossessed in its favor. Meynert elaborated the suggestions and facts of his predecessors, and the theories are customarily ascribed to him. It is adhered to in his latest publication (*op. cit*)

[‡] I proposed some years ago that the area of a trans-section of the spinal cord at the level of the foramen magnum be taken as a unit standard of comparison, and the average between the trans section and flat-section of the cerebral hemispheres expressed in such units. This would give an approximate idea of relative cerebral development in different animals. Or the cubic area of the brain might be expressed in cubes of such a unit. Either method would be physiologically more just than the comparison of brain weight and body weight.

Contrary to what many believe, the porpoise is an animal of exquisite sensibility, skilled motor endowments aud a high emotional nature, as well as possessed of considerable judgment. The reader will find some facts pertaining to this in another part of the article.

The absence of pyramids in these animals shows that intellectual (voluntary) motor control may travel through other nerve tracts than the pyramids. I shall recur to this special question after completing the survey of the surface character of the so-called pyramids in other of the animals examined by me.

II.—HISTORICAL OBSERVATIONS.

As the history of the discovery of the anterior pyramids and of the various views announced about their relations is not the last interesting chapter of this subject, and some of the errors of the older, and even some modern, writers, are quite instructive, I will briefly mention them here.

The anterior pyramids were first noticed by Eustachius, but Willis described and named them. Malacarne found that they become narrower towards the cord, and gradually disappear from the surface. At this period only the surface features of the brain were well studied, and the substance of the knowledge of the day may be summed up as follows: In man, the pyramids (*corpora pyramidalia antica*) are two columnar elevations, bordering the basilar fissure of the medulla oblongata, large and prominent at their cephalic end, they become lost under the posterior border of the Pons, while their narrow and sharply-pointed caudal ends dip into the fissure which lies between them, and which they border.

It was Mistichelli who discovered that the fibres of which the pyramids are composed decussate (that is, cross into the opposite side of the spinal cord), and he recognized, nearly two hundred years ago, the relation of this fact to the well-known observation, that in paralysis, from cerebral apoplexy, the paralysis is on one side of the body.* His description was inaccurate in detail. It was corrected in part by Santorini, but succeeding writers contested or doubted the existence of a decussation till Gall forever set the question at rest and demonstrated its coarse relations very clearly. By him it was supposed that each pyramid crossed the median line as a totality, but Rosenthal first asserted that while the greater part crosses into the opposite half of the cord, a small portion remains on the same side. This view is the one accepted at the present day. To the same author belongs the credit of having shown that the decussating part of the pyramids is derived from the opposite lateral, and not the anterior, column of the spinal cord, as had been supposed by his predecessors.

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* Opposite to that of the disease.

Lockhart Clarke, who also discussed the historical aspect of the question, appears with Serres, whom he cites, to have been the first to study the comparative anatomy of the pyramids. He recognizes that, while as wide or nearly as wide in lower mammals as in man, that they are of equal depth in no animal. He says: "They are also of considerable, but variable, size in all the mammalia, and in some of the larger beasts of prey, as the lion, hyena and jaguar, I have found their external dimensions to be nearly, if not quite, equal to those of man, but in depth they are smaller among this class of animals. Well-marked, prominent and rounded in the quadramana—at least in the simiadæ—they are broad and flat, but usually larger in the herbivora, and in the elephant, though far from proportionately broad in relation to the size of the brain, they are long and tapering. 'According to the hypothesis,' says Serres, 'that the pyramids are the roots of the cerebral lobes, their development ought to be proportionate to them; now, this is not the case; the pyramids are less bulky in man than in the apes, and they are much more pronounced in the cetacea. This predominance of the pyramids extends also to the carnivora—the lion, bear, weasel and others; to the pachyderms and ruminants.' In relation to the size of the cerebrum, it is true that the anterior pyramids are smaller in man than in some of these animals, particularly the larger carnivora, such as the lion and hyena; but actually their dimensions are in some instances much greater. In the herbivora especially the superficial breadth of the pyramids is no indication of their actual bulk, which can be ascertained only by means of transverse-sections; for although they are frequently very broad, and *rendered prominent at one part by the olivary bodies behind them* (italics ours), they are much more shallow than in man, *and their decussating fibres are much less numerous* (italics ours) * * * * * " Elsewhere he says of the decussating fibres of the pyramids, "I have found their number to be in the direct ratio of the *prominence*, rather than the breadth of the pyramids. They proceed more from the *deep* strata of the lateral column, and less from the *superficial* and *anterior*, so that the whole decussation, as will be seen later on, resembles rather the *upper* portion of that in man." "In the cat it is stronger than in the dog, sheep or ox, and a transverse section through it presents a very beautiful appearance. A transverse section of the medulla oblongata of the tiger bears, in every respect, a most striking resemblance to that of the cat, the decussating fibres are numerous, and the anterior pyramids are consequently prominent and deep, so that relatively to the size of the cerebrum they are decidedly larger than in man. In the guinea pig, also, the decussation is well-marked, and the fibres it derives from the posterior columns and the gray substance may be very distinctly seen."

It is evident from these citations that Clarke was on the threshold of making an important discovery, one that would have been of value to the classifying zoölogist as to the human and veterinary pathologist. He was unfortunately hampered by the now demolished theory that the fibres which decussate from the nuclei of the posterior column in the fir-cone deccussation, to form the inter-olivary layer, are a part of the pyramids. His ingenious observation that the "decussation (in herbivora) resembles rather the *upper* portions of that in man," is to-day to be read thus: Only the fir-cone decussation (piniform deccusation) is present to any noteworthy extent in the hoofed animals. Clarke also saw the door open to the conclusion which we shall advance as to the relation between prehensile function and the pyramid tract, when he noticed that the cat and tiger had nearly as large pyramids as man. But he went no further than the observation, and drew no conclusions from it.

With regard to the singular argument of Serres, cited, the making of transverse sections (advocated with so much reason by Clarke) seems to have been neglected by him. Since he, in consequence of this, mistook the olives for pyramids, his objection to the theory, sustained by most writers, falls to the ground. In addition, he was misled by the luxuriant arciform cingulation of the human oblongata, inferring that the pyramids were, *de facto*, less prominent than in the apes. In truth, it is the reverse.

Dean*, the only earlier American writer who has devoted much attention to the subject, says, in speaking of the changes undergone by the cord as it passes into the oblongata, "The pyramidal columns which, in the sheep are very small, are now quite distinct, and numerous fibres run parallel to the axis of the medulla, forming with the unciform fibres which decussate with them the raphé," In speaking of the olivary relations, he says: "In the cat, and carnivora generally, the anterior pyramids are deeper, and approach more nearly to the human type than the sheep's."

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* The gray substance of the medulla oblongata and trapezium.

In this connection, I think it but justice to Solly to state that although writing in 1847, he was possessed of a knowledge of all the facts relating to the olives above cited from Clarke and Dean. Indeed, he seems better than any other early writer, to have recognized the real source of the discrepancies among authorities (*vide* pp. 107, 108): Longet says ("Anat. et Phy. du Systeme Nerveux de l'Homme et des Animaux Vértébrés," p. 390), "The olivary bodies attain their highest development in the human species. It is often impossible to perceive these eminences in other mammalia." "Having carefully examined," says Rolando, "the place where these eminences ought to be, I can assert that they are not to be met with in the ox, pig, sheep or goat." Carus affirms that they are wholly absent in most mammalia, or at least, that they do not present the arborescent appearance of white and gray neurine which they do in man. "I have found these ganglia in the sheep, horse, calf and cat, and I have no doubt that they exist in all the mammalia." "Gall," says Longet, "has certainly exaggerated their volume in the calf; they are sufficiently apparent in the ape, but especially apparent in the porpoises and in the dolphins." In the sheep the *corpora olivaria* do not project on the surface. They are best detected by a transverse section; and they will be found not on the side of the pyramidal bodies, but behind." Solly is, however, very vague about the relations of the pyramids and trapezium. Thus in Fig. 51 (base of sheep's brain) he represents the trapezium crossing bodily so as to entirely conceal the pyramids. In Fig. 55 (base of the horse's brain) he represents the lines of the lateral pyramid boundary, and of the posterior border of the trapezium crossing each other. One of these lines, of course, must be fanciful. The sketch of the base of the elephant's brain, evidently made by the author himself (Fig. 57) represents magnificent olivary protuberances and pyramids, side by side. Either elephants differ among themselves beyond the customary range of variation, or the draughtsman labored under illusions. Probably Owen, whose description of this brain Solly cites, interpreted it more correctly, for he speaks of the large size of the *corpora olivaria*, and says nothing of the pyramids. Solly correctly appreciates the enormous development of the olives in the porpoise, but he makes this singular interpretation. "The corpora olivaria are so amazingly developed that instead of being separated from each other, as in the human being, by the corpora pyramidalia, they *overlap and cover* these so completely as even to come into contact with each other, in the median line." They can come into such contact only in the absence of the pyramids.* Solly probably fell into this error in attempting to reconcile Leuret's and Tiedeman's figures.

In another place (pp. 183, 184) Solly discloses a fact which, if sufficient stress had been laid on it, and if his work had been less ignored, would have rendered this discussion unnecessary. "In the sheep, the horse, the cat and calf, I find that there is a wavy line of gray matter in the very centre of the corpus pyramidale, which is clearly the analogue of the corpore olivaria in man." He fails, however, to see that this fact opposes the existence of a true pyramid in these animals; on the contrary, he utilizes it to prove that the olives and olivary tracts have motor relations. Besides, his statement is incorrect as far as the cat is concerned.

How little advance has been made since the days of Solly? Bastian, who by-the-by, "lives on" Solly, as far as the anatomical portion of his work† is concerned, does not seem to have been able to master even the correctly given details furnished by his predecessor. He figures a dolphin's brain, from Owen, after Tiedeman (Fig. 74) in which the very bodies, correctly designated as olivary by Solly, are termed pyramids, being sufficiently distorted to merit that title.*

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* As in human monsters whose pyramids are absent, in consequence of non-development of the hemispheres.

† "The Brain as an Organ of the Mind," 1880. This book has had the unmerited honor (like Beard's "Creation") of a German translation. In neither case, I think, reflecting favorably on the discriminating power of German publishers. In this connection, I desire to correct an erroneous reference in my article on the Corpora Quadrigemima ("Mitheilung die angebliche Abwesenheit der Vierhügeltheilung bei Reptilien Betreffend Mendel's Centralblatt," 1884) I there attributed a figure of the boa's brain to Solly, it really being Fig. 58 of Bastian, and is taken by him from Rhymer Jones after Swan. It is only approximately correct in regard to the corpora quadrigemima.

Aside from a few disconnected observations made by Stieda, I can find nothing else on this head,† excepting the important cautionary statement of Flechsig relating to the brains of the muridæ, and to which I shall have occasion to direct special attention.

III.—Comparative Characters.

I have myself examined a large number of brains, and noted the peculiarities of the pyramids in them. In order that none of the conclusions advanced in the following pages may be wrongfully supposed to apply to forms allied to those examined by the writer, but not now at his disposal, I append a complete list of them, arranged in their zoological order.

PRIMATES.

Anthropidæ: Man.

Simiadæ	Anthropomorpha	Orang.
		Chimpanzee (three specimens).
	Cynomorpha, Old World Catarrhine Apes:	Semnopithecus entellus.
		" maurus.
		" mitratus.

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* In Solly's figure (from Leuret) there is some indication of a remarkable body connected with the auditory nerves, and which in structure, at least, does not appear to be the trapezium, but a mingled ganglionic and fascicular mass related to those nerves, which, as known, are larger in the porpoise than in any other examined mammal. Gross and inexcusable errors disfigure Bastian's text. Thus, he speaks of the corpus trapezoideum as concealing the olivary bodies from view in lower animals, and shrinking cephalad to expose them in higher—thus showing that the primitive discrimination between the nucleus of the trapezium (upper olive) and the true olive, was not at his disposal. The condition of medical book reviewing to-day may be inferred from the fact that but a single review of the many calls attention to the numerous similar errors in this work.

† Among those who have devoted attention to comparative cerebral anatomy, it is the veterinary anatomists above all who have evinced the least originality and criticism in observation. Indeed, they seem to have accepted the description of the human brain as applicable to that of the horse, attributing to it the same nerve tracts, ventricular features, etc. Occasionally one of these authors, rather than mislead his pupils, in the absence of any positive convictions, leaves his descriptions and, occasionally, the accompanying illustrations so obscure and ambiguous, that it is left to the student to draw his own inferences. To illustrate this, I need but point to the plate of the base of the horse's brain, and the manner in which the boundary lines of trapezium and pyramids intersect in McFayden's book, and this is a superior one of its class.

	Cercopithecus griseo-viridis.
	Cynocephalus babouin.
	“ porcarius.
	“ olivaceus.
	Macacus radiatus.
	“ cynomulgus.
	“ nemestrinus.
	“ rhesus.
Platyrrhini, New World Apes.	Ateles melanochir. Nyctipithecus trivirgatus. Cebus capucinus.
Arctopithecini, Marmosets.	Hapale jacchus.

LEMURIDÆ : Arctocebus calabarensis.*

CHEIROPTERA.

(Frugivora) Pteropus fuliginosus (5 specimens).

Insectivora	The common Austrian species. “ “ New York species.

INSECTIVORA.

Scalops Americanus.*

RODENTIA.

Lepus Americanus.
“ cuniculus.
Cavia cobaya.
Cælogenys paca.
Sciurus.*
Hystrix Canadensis.
Mus ratus.
“ musculus.
Castor fiber.*
Arctomys monax.

CARNIVORA.

FISSIPEDIA : Canis familiaris.
“ vulpes (Americanus)

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[*] I take pleasure in recording my obligations to Dr. William A Conklin, of the Zoölogical Department of the Central Park Menagerie, and Mr. Henry Reiche, proprietor, with Dr. Dorner, the Superintendent of the N. Y. Aquarium, for the majority of the rare animals enumerated in this list. In addition, I am indebted to Dr. E. G. Messemer for the brain of one black bear, to Dr. E. C. Seguin, for that of a rhinoceros, to Dr. Miles, of Baltimore, and Prof. Osborn, of Princeton, for several opossum-brains; to Dr. H. G. P. Spencer, of Watertown, two porcupines; to Dr. E G. Rave, of Hicksville, for that of a woodchuck, and to the exertions of Mr. Cohn, formerly connected with the Barnum show.

Felis leo.
" leopardus.
" catus.
Ursus Americanus.
" (Helarctos) Malayanus.
Procyon lotor.*
Nasua rufa.
PINNEPEDIA: Lutra Virginica.*
Zalophus gillespiei.
Phoca vitulina.

PROBOSCIDEA.

Elephas (Loxodon) Africanus.

UNGULATA ARTIODACTYLA (RUMINATIA).

Cephalophus mergens.
Cariacus Virginianus.
Capra hircus.
Ovis aries.
Bos taurus.

UNGULATA ARTIODACTYLA (NON-RUMINANTIA).

Sus scrofa.
Hippopotamus.

UNGULATA PERISSODACTYLA.

Equus caballus.
Rhinoceros * (two-horned dark species.

EDENTATA.

Cholopus didactylus.
Dasypus sexcinctus.*

MARSUPIALIA.

Didelphis Virginica.*

On glancing over this collection, I was struck with the presence of two prominent types of pyramid development. These I shall call:

I. The pyramid of pointed and defined termination.

II. The pyramid of diffuse and undefined termination.

I might have enlarged the series, if in addition to my own dissections, I had utilized the drawings and descriptions of previous observers. Unfortunately these are, with rare exceptions, unreliable. Clarke, Dean, Huschke, and the much-ignored Gall, alone have correctly represented the base of the brain in several species of animals. Even where the author cannot be suspected of carelessness or neglect, his artist has taken liberties with nature that mar his representations. Thus, one of Gudden's best papers is accompanied by two plates containing no less than five types of pyramid development in one and the same species of animal—the rabbit—one, at least, of which I do not believe is a possible one. Those species represented by imperfectly preserved specimens are marked by an asterisk.

The noteworthy feature of these two types is that they closely follow certain zoölogical limits. The first is found in *all* the Primates and Carnivora. The second is found in *all* the Ungulata. I shall give reasons when discussing the deep structural relations, for regarding the condition found in the cetacea and proboscidea, as an extreme phase of the second type.

The following diagrams illustrate the salient features of both :

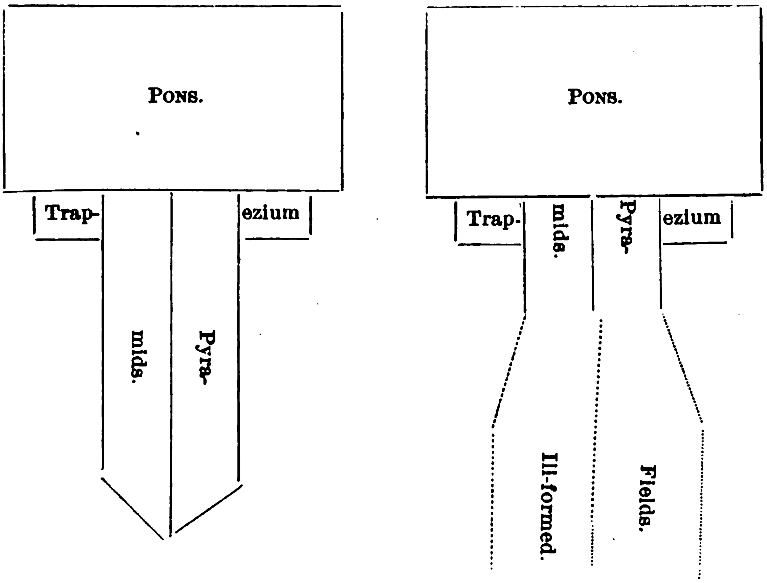

Fig. 14.

First Type. Second Type.

The second, or aberrant type, has the smallest pyramids. The brains showing it comply with the requirements of its definition previously referred to, only so far as the cephalic end of the pyramid is concerned. Here they are distinctly columnar, and lie, to the naked eye, at least, ventrad of the trapezium. But towards the cord they are more indistinct.* In the first place, the hoofed animals, instead of a ventricular (basilar) fissure, on the greater and caudal portion of the oblongata, have a faint sulcus. Consequently, the demarcation between the two pyramids, which is very distinct in the first type, is but faintly indicated. In like manner, the ectal (outer) boundary, which is marked in the first type something as a steep but low hill is marked against the underlying valley, is, as it were, blurred, and as we shall see, and as Solly discovered, is in the main due to the prominence of concealed structures. In the hippopotamus, indeed, it is impossible to identify the dividing line between the so-called pyramids and the lateral field of the oblongata,* except by means of the nerve roots. In none of the ungulates, that is, the animals exhibiting the second type of pyramid, is a decussation of pyramid

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* The apparent exception, offered by the sheep's brain, and to be discussed further on, does not invalidate this rule, for the distinct line in that case is not the ordinary boundary, nor homologous with it.

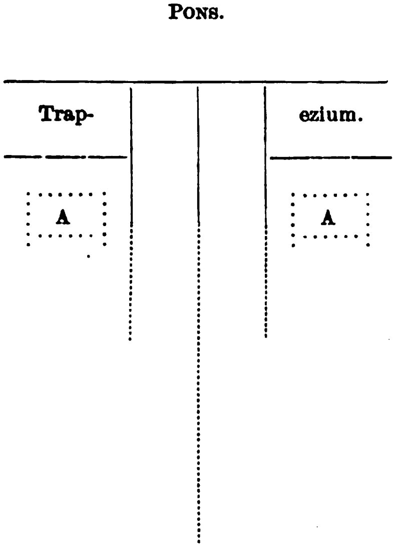

Fig. 15.
Type of the hippopotamus.

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* I refer, of course, to the posterior (caudal) part of the oblongata. In the anterior or trapezial portion there is a slender pyramid pair, of even more attenuated dimensions than in the calf. I may add here that the lateral field of the oblongata in the hippopotamus bears a round, faint elevation on each side, laterad of the pyramid and caudad of the trapezium. Possibly they correspond to the lower facial nucleus. (A, A in diagram).

fibres made visible on separating the ventral fissure of the oblongata, although represented as so occurring in numerous treatises. In the first type—that found, from man down to the fox, including all the primates and carnivores, the "pointing" of the pyramid is accounted for by the dipping of its component bundles into the ventral fissure, to cross the median line at its floor, and enter the deep tissue of the lateral column on the opposite side. It is this crossing (decussation) of the major part of the pyramid tract, which accounts for the fact that when the motor centers or tracts of the brain are injured on one side, the ensuing paralysis is on the opposite side of the body. This is an almost invariable law for all the animals exhibiting the first type of pyramids, for, as stated, they all have a decussation of that tract.

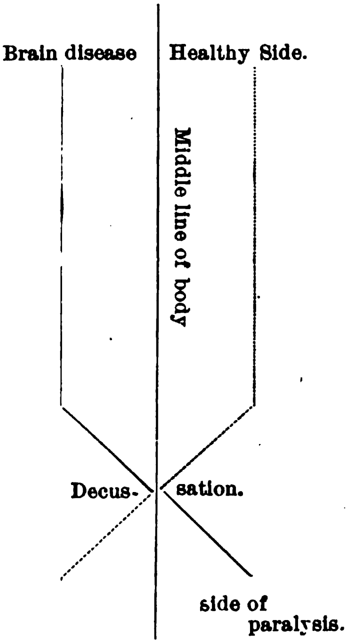

Fig. 16.

I will add, provisionally, that as regards the external relations, the pyramids of the cheiroptera (bats) and rodentia, belong to the first type.

It would, however, lead to serious error, for reasons partly stated before, to attempt a classification of the pyramid tract, grounded on external characters alone. Transverse sections should be made to show the extent and deep relations of that fibre mass whose plastic elevation constitutes the so-called pyramids. Since the study of the human brain has been greatly advanced within the past decade, and constitutes from the unanimity of observers as to its most important features, as well as its representative character,* the best standard of comparison, let us proceed to lay down some of the primary facts which are to aid us in this inquiry.

IV.—DEEP RELATIONS.

The medulla oblongata, on being cut transversely to its long axis, is found to exhibit a sort of butterfly pattern. Its two halves are united by a strand of "up-and-down fibres" known as the *raphe.* The nuclei of certain cranial nerves lie at the floor of the Fourth Ventricle (H, G, V.). From one of these, the hypoglossal nucleus (H, h) the beautiful sweep of the roots of the hypoglossal nerve can be traced, ventrad, to emerge at the surface in a furrow which separates the rounded contour of the pyramid from the similarly round contour of the olive. At no distant date all that large fibre mass, represented in the figure by the black spaces between the raphe and hypoglossal roots, was supposed to be the pyramids.† Now, however, only the part included between the lowest one-quarter of the hypoglossal and the lowest sixth of the raphe is designated as the pyramid tract (P). Immediately dorsad (above) that is, lying between the olive and the raphe, is the inter-olivary tract (L). The remainder of the field included between the raphe and the hypoglossal root, is usually known as the internal division of the "reticular field." Those of its fibres which are nearest the hyperglossal nucleus, are a continuation from the posterior longitudinal fasciculus of the tegmentum. It is thus seen that the once unified pyramid is in reality composed of four super-

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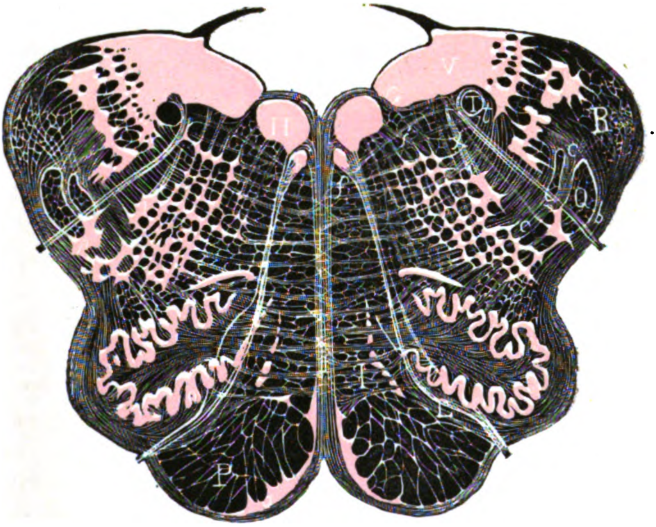
* The cat, originally suggested by Wilder, may take this place some day, particularly as this animal, of all those on which the atrophy method can be tried, is nearest the human type. But for the present this is not feasible.

† Even by so recent an authority as Henle.



TRANSVERSE SECTION OF OBLONGATA AT THE MIDDLE OLIVARY PLANE.

The ganglionic substances are represented by a red color; the conducting strands divided in the section by black areas; those running in the plane of the section, by white lines.

imposed strata which, if we begin near the floor of the ventricle and dig through the oblongata, would be exposed in the following order:

1. Posterior longitudinal fasciculus of the tegmentum.
2. Internal division of the reticular field.
3. Inter-olivary layer.
4. Pyramid tract (properly so-called).

In properly hardened specimens it is not difficult to distinguish the pyramid tract, as its color is slightly different from the other parts, and there is often a well-marked connective septum, or a gray intercalation belonging to the arciform nuclei, to indicate the separation.

In all the primates, the development of the pyramid tract is proportionate to the intellectual rank, and progresses quite evenly with the olivary body. Taking the area of one-half of the oblongata as 100, the following is the proportion borne by the area of the pyramid immediately above the decussation:*

Man	30
Chimpanzee	23
Cebus	10

Intellectual rank, or what is the anatomical index of such rank; preponderance of the highest nerve centres is not the only factor determining the size of the pyramids. The dimension of the animal has undoubtedly some influence. Thus, a large mastiff has a larger pyramid, proportionately, than a small terrier; a lion similarly exceeds the cat in this respect, and the bear the coatimundi. In drawing inferences, therefore, the size of the animal must not be disregarded. Something similar is to be said of the olivary bodies. The main nucleus of them is a simple U in the marmoset; it shows two convolution (denticulations) in a cebus; five in the baboon; twenty in the chimpanzee, and sometimes thirty in man. But it must be remembered that in small animals, the cerebral hemispheres are smooth, although convoluted in larger genera of the same zoölogical order.*

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* Spitzka—"The Peduncular Tracts of the Anthropoid Apes." *Journal of Nervous and Mental Diseases*, July, 1879. In this paper, which mainly includes measurements, the general conclusion is drawn that, if we were to represent the average development of the higher (hemispheric and cerebellar) tracts of the human being as 100, the chimpanzee would rank about 75, the baboon at 40, the cebus at 25, and the dog at 7½.

As the pons is longer in the leopard than in the cat a similar rule may apply to this tract.

No inference seems so natural as the one, that if the pyramids control the motion of the extremities, they must increase in size with the elaboration of skilled limb-motion, and decrease where these motions became less skilled. The facts, however, do not seem to be in full accord with that inference. The phocidæ, or seals and sea-lions, are aberrant carnivores, whose anterior extremities have undergone involution into flippers. On land they are unable to move with any rapidity,† and their fore-legs are not employed in the hundred motions which the cat, the dog and the bear enjoy: yet the sea-lion's pyramid tract is far superior in comparative bulk to that of these animals. Indeed, it compares favorably to that of the anthropomorpha. It may be that this is referable to the fact that the sea-lion, although the peripheral disposition of its extremity motors is clumsy, has a more absolute control, *i.e.*, voluntary control of them. It is certain that the seal can be more readily trained to use its apparently helpless flippers for acts requiring voluntary co-ordination than the dogs or cats. They can be trained in a few days to turn the handle of a barrel organ, no slight temptation, to acquiring the necessary

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* Where this does not obtain, it is found, so far as I am able to say, that the discrepancy in general cerebral development is very great. Thus, the seal is a much smaller animal than the sea-lion, but it has as well convoluted a brain. With this the frontal lobes exhibit a great preponderance. In fact, their redundant development is so great that the olfactory tract is crowded into the sulcus rectus, and the gyri bordering it, overlap it and meet, so as to conceal it from view. The seal is, however, a higher development of the phocidean type. I know of nothing, except the pedigree of the equidæ that seem so continuous as the series; vison, fresh-water otter, marine otter, eared seals and earless seals. The series of brains emerges imperceptibly in this series from the dolichencephalic marten, with some ursine affinities, to the brachyencephalic seal. I may say, in passing, that the appendicular lobe of the cerebellum is enormous in the latter, and imbedded in ivory-like bone, so that I am not surprised to find it unrepresented in somes figures, it having escaped the dissector.

† Luciani's claim that the dog, whose cerebellum is removed, loses his coordination in land movements, but retains his equilibrium and power of action in the water, cannot be utilized to support the claim that a cerebellum is unnecessary in aquatic animals. The seal and sea-lion (not to mention the porpoise) have most complicated and heavy cerebellar ganglia—far higher in complexity than those of the dog.

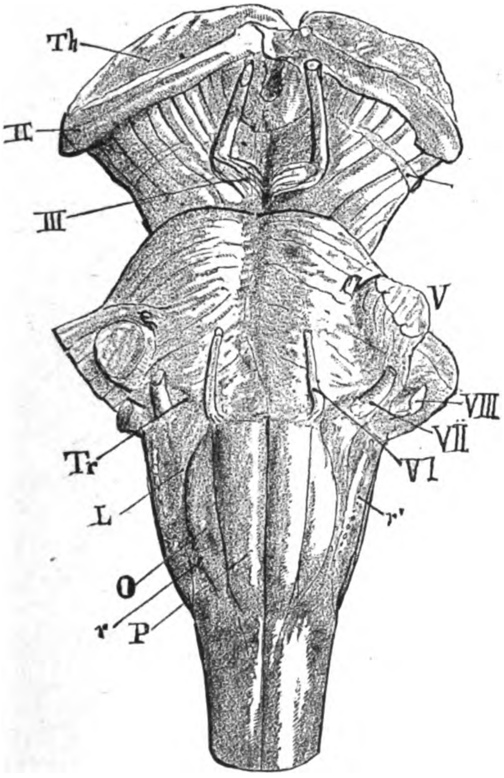

Fig. 17.—Basilar view of the sea-lion's (*zalophus gillespiei*) isthmus. Th., cut surface of thalamus; II., optic tract; III., third pair; V., fifth pair; VI., VII., VII., other cranial nerves in their order and numerals; Tr., trapezium; L., lateral field of oblongata; O., olivary eminence; P., pyramid; r., roots of the twelfth pair; r'., roots of the ninth, tenth and eleventh pairs.

skill, being the exquisite musical ear which these animals have. The lines of Scott:

> "Rude Heiskar's seals, through surges dark,
> Will long pursue the minstrel's bark."

are substantiated by experience and by the high development of the auditory nerve roots* and nuclei. The complicated cerebellum of the seal is probably an expression of its position as an auditory ganglοin, for the restiform column which is the spinal afferent to the cerebellum is atrophic in the seals as compared with the land carnivores. This fact is opposed to Ross' theory, that the restiform is a vegetative tract. The seals have larger visceral cavities and more complicated vis-

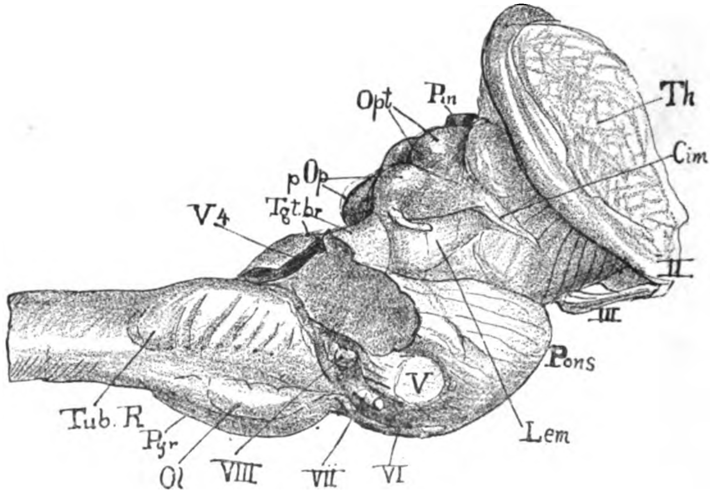

Fig. 18.—Lateral view of the sea-lion's isthmus. Cm., cimbria (tractus peduncculis transversus); Pn., pineal body cut; Opt., anterior pair optic lobes; pOp., posterior pair post-optic lobes; Tgtbr., anterior cerebellar peduncle, tegmentabrachium; V 4, fourth ventrical; Tub. R., tubes of rolando; Lem. lemniscus, pons, pons varolü; other references same as in preceding figure.

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* The porpoise, whose auditory nerve is nearly double the size of the human, has probably the most acute sense of hearing in the animal kingdom. Mr. Sparks, owner of the porpoise fisheries at Cape Hatteras, informs me that his fishermen are very careful not to make any noise in laying the large nets intended to entrap them, and that porpoises have been known to change their course when an unusual noise has been made at a distance of *two miles*. He has also related to me interesting instances of *esprit de corps* among these animals, and of their high emotional nature (the porpoise will shed tears like a child when captured) which harmonise with the high cerebral development. The observations thus far made relate only to the acuteness of hearing, not to such appreciation of melody for which the seal is noted. The high development of the porpoise's brain has long been a fruitful theme for surmise among philosophers. Indeed, it was even claimed that a large brain could not be an index of mental development, because the aquatic mammalia (presupposed to be stupid) had them. The observations of an officer in our revenue marine (Capt. Charles M. Scammon, California),

cera and visceral functions than the land carnivorse, but the latter have far bulkier restiform columns*. It is more probable that it can be made to harmonize with Luciani's discovery, that the aquatic movements of the dog are less interfered with than the land movements when the cerebellum is destroyed, if we remember that the restiform derivation of that ganglion preponderates in land carnivores, and the auditory derivation in aquatic carnivores.

From the forgoing it must be evident that the definition of the pyramid tract as it existed in the minds of comparative anatomists, has been too exclusively modelled on the well-ascertained facts of human anatomy. The comparative anatomist should define these bodies as follows :

The pyramids are elevated columns of the medulla oblongata, bordering the ventral fissure of the latter, and extending from the caudal border of the Pons to the inflection of the oblongata. They are never concealed by the trapezium.

The above definition takes no account of deep structural relations, or the functions of the nerve tract, to which the pyramid of the human oblongata has given its name. Before proceeding to analyze these, let us coarsely delineate the various types of pyramids found in the mammalia who possess them.

A. This type is found in man, the chimpanzee and the ourang-

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however show that the cetacea are very sensitive, wary and emotional. They are warmly attached to their young, confirming the accounts of the ancients about the dolphin, regarding which the great Leuret said, "That while fiction might be mingled with them, they must contain some truth." Bastian (loc. cit.) cites observations made on porpoises at the Brighton Aquarium, supporting Leuret's surmise. I have seen but one, a bottle-nosed dolphin, in captivity at the New York Aquarium. It slept neither by day nor by night, and for three weeks raced back and forth in the large tank, till it died. I inferred that this animal, accustomed to the boundless liberty of the ocean, does not manifest its natural traits in a tank any more than a man locked in a Utica crib against his will is likely to show to advantage.

* In the porpoise the facts seem to be reversed, but until the cord of this animal has been thoroughly studied the homology of the apparent restiform column is not to be considered established. It may be an overgrown inner division of the cerebellar peduncle (Meynert). I refrain from a full discussion of the seal's isthmus, as my assistants, Drs. N. E. Brill and R. Mollenhauer, are engaged in a monographic study of the subject in my laboratory. I would merely state, as my own observation, that a new nucleus, containing small nerve cells, has been discovered in the tract of the emerging facial nerve root, and that the proportions of the oblongata and pons are quite human-like in many respects. The hypoglossal nucleus is atrophic.

outang. In short, it is characteristic of the anthropomorphæ and of the anthropidæ. In the latter, the sharpness of the termination is often concealed, as are also other boundaries, by the luxuriant development of the arciform system of zonal fibres. Individual variation is claimed by Flechsig.

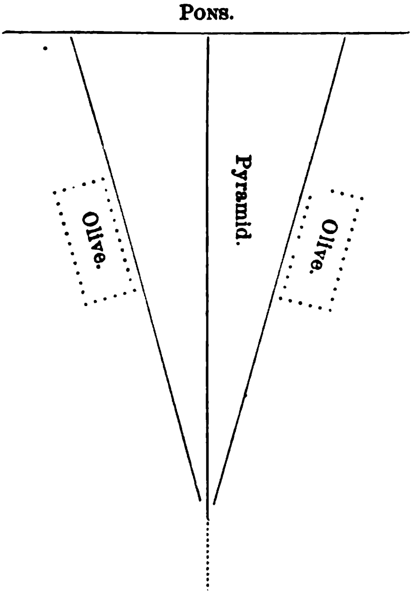

Fig. 19.—Type A.

The type found in the Old and New World monkeys, excluding the marmosets and lemurs is a modification of the previous type, due to the flaring out of the pyramids caudad of the olives. (Type B, Fig. 20.)

In all true monkeys the pyramids are salient, taper backwards and decussate into the opposite lateral column. In man, the chimpanzee and ourang, they are sub-cylindrical and taper gradually backwards. In semnopithecus, ateles and allied forms, the same is noted, with the exception that there is a slight flaring out at the posterior end of the olives. Even in the marmosets (nyctipithcus and hapale) the pyramids are bold and well-marked down to the pointed spinal end.

CARNIVORA.—Decrease the surface projection of the olivary fasciculus (Fig. 17) and add a corresponding bellying to the middle third of the pyramid (Fig. 18) and you have the carnivora type!

Inasmuch as the ursidæ and sea lions have a much larger pons than the other groups, it follows that the trapezium is smaller in them. In all the carnivora the posterior (spinal) end of the pyramids is pointed, being less sharp in the viverridæ then in the others. In the region of the olivary nucleus, the pyramid widens out. This is due to the bulging influence exerted by the former, which underlies them. A powerful decussation into the lateral column can be demonstrated in all. The pyramid is entirely ventrad of the trapezium.

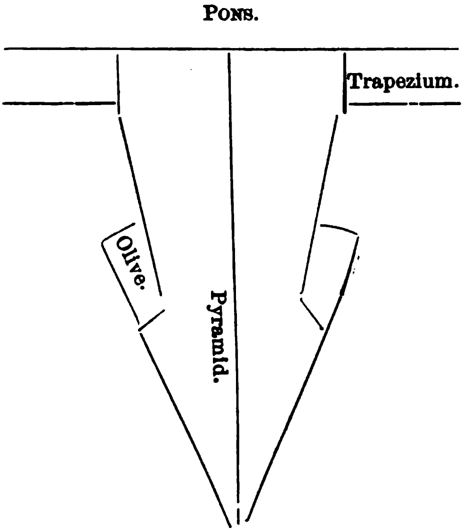

Fig. 20.—Type B.

MARSUPALIA.—In the opossum very distinct but small pyramids are visible. They have the typical situation in the pons, but the trapezium is so large that the slender pyramids, passing ventrad of it, undergo a sharp bend in passing to the caudal oblongata. If the brain be supposed lying with the base up, the pyramids may be compared to a stream of water coming out of a cave—in the pons—and forming a low cascade at the caudal edge of the trapezium, to descend to the lower plateau of the oblongata. The decussation I have not yet examined, but as the pyramid flattens out posteriorly and appears as if diffused into the anterior column of the cord, it cannot be a considerable one.

EDENTATA.—As clumsy as these animals appear, as rudely modelled is their oblongata, the pons, which is bold and rounded, is the only salient feature, no pyramid tract nor olivary elevation is distinctly visible. The trapezium is faintly indicated, and appears to extend uninterruptedly across. (?) In an armadillo (dasypus) there is a faint indication of a pyramid elevation, without any enlargement in its course, which ends blunt at the basilar crease. The pons, compared with the sloth, is proportionately about three-quarters its size.

VESPERTILIONIDÆ.—The pyramids of the bats are well-marked. A curious feature is that, unlike other animals with decussating pyramids, those of the bats decussate as distinct bundles, not interdigitating by fasciculi. This is the condition in the small bats of the temperate zone (vesperugo, vespertilio). In the large fruit bats (pteropus fuliginosus) a more remarkable feature is added, the pyramids do not decussate in the ventral fissure, but on the basilar face of the oblongata,* so that a distinct letter X can be seen in relief here. The bundle after decussation can be traced a considerable distance, gradually losing itself in the lateral column.

Not only is the decussation of the frugivorous bats singular in its external appearance, but the course of the pyramid bundle is found to be aberrent on cross-section. While it occupies the typical position in the crus pons and trapezial part of the oblongata, it decussates, not at the junction of the cord and oblongata, as in all other animals in whom a decussation of the pyramids occurs, but high up, immediately caudad of the trapezium, so that the crossed pyramid tract, after crossing, lies in the altitude of the olive, on its outer side. The crossed pyramid tract of the bat decussates entirely on the ventral surface of the oblongata, and is then situated, not in the deeper portion of the lateral column, but at the periphery of the oblongata, ventro-mesad of the direct cerebellar tract, and abutting against the processes of the nucleus antero-lateralis (of Dean and Clarke). Probably this peculiar decussation of the pyramid tract is related to the predominence of the wing-like anterior extremities, to reach whose extended nucleus the brachial will tract crosses earlier and *en masse*. The restiform column of this animal, like the pyramid tract, is large. A section immediately below the decussation, presents a singular appearance to him who is familiar with the ordinary relations among mammals. The crossed pyramids lie at the ventro-lateral periphery of the oblongata, the roots of the twelfth pair mesad (internal to) of them, and within these the typically developed olives, whose outermost parts are occasionally perforated by the nerve-roots mentioned. The olives and hypoglossal nerve-roots extend, therefore, caudad of the decussation. The latter run sharply laterad after emerging, closely applied to the membranes of the ventral face of the oblongata.

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* Spitzka, *Journal of Comp. Med. and Surg.*, vol. 1., 18.

The arciform fibres field off the crossed pyramid to plunge after the usual method, into the restiform column. In some levels the nucleus of the column of Goll appears as if appended to that of the column of Burdach. and its homology is not at all very clear.

ARTIODACTYLA (RUMINANTIA).—The brains of all these animals are very similar in their basilar aspect. That of the sheep has been carefully described by Clarke and Dean, as previously stated. These observers have not made their naked eye observations as minutely as Gall,* probably because they studied the brain after it was hardened in alcohol. Alcohol, unless used in cold weather, obliterates the more delicate contours of the base of the brain. In the fresh state, or in the specimen hardened in bichromate of potash the sheep's oblongata shows a beautiful sculpturing which has escaped the artists, if not the authors of the above works, with the exception of the founder of phrenology, who, if an incautious theorizer, was a truthful and thorough observer, and—for his day—a master of encephalic technology.

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* The base of the brain of the calf in Plate III. of his great work is most accurate, as compared with Bastian, and even Solly. In as far as he designates the olives incorrectly he is not at all behind the former; a writer of this decade. As I have found a distinct "fifth ventricle" (pseudocele) in a calf, this adds a second to the animals below the simiadæ, who possess it; it having been found by me and confirmed by Wilder, in the dog. I have also found *striæ* at the floor of the fourth ventricle of the cat, not homologous with those of man, but in the same situation.

The brain axis of all ruminants is physiologically speaking, inferior to that of the carnivora. In the flatness, it approximates that of the sauropsida, marsupials and edentates. The smallness of the posterior corpora bigemina (post-optici) as well as their position, presents a phase of evolution which is but slightly removed from that ascertained in the iguana and alligator by Spitzka. It has been customary to designate as pyramid the column previously referred to under that name. This column, however, except in its sub-trapezial course, is in great part due to the prominence of the internal accessory olive, to which the main olivary nucleus is added in the middle third. Most of the mass is composed of zonal fibres. On cross section, only small divisions of descending fibres are noted. These gradually decrease caudad, and it is extremely probable that a pyramid tract, in the physiological sense, exists only in so far as controlling fibres are needed for the supply of the cranial nerve nuclei, and that the locomotive mechanism, involving the function of the extremities is controlled through some other, probably a thalamic tract. Hemiplegia is the rarest of accidents in veterinary practice. Brachial diplegia—paraplegia, or panplegia of the extremities are the typical forms of paralysis in the herbivorous domestic animals.

The fibres of the trapezium in the cat, dog, lion, sea lion, bear, coatimundi, ape and man run clear of the true pyramid, as seen in cross-sections. In the calf, sheep, and all other artiodactyla examined, they encroach on the pyramid more or less. Lower down in the oblongata, the same obtains with regard to the transverse fibres of Lenhossek's so-called commissure. In the first class of animals these never encroach on the pyramids. In the last-named they always do. The following appear to the writer distinct criteria of certain zoological groups.

PRIMATES AND CARNIVORES.—Man, apes, dogs, cats, bears, seals.	UNGULATES.—Horse, horne animals, hogs, rhinoceros, etc.
1. Pyramids, defined throughout, *a* in their lateral boundary; *b* in their termination on cross-section.	1. Bodies termed pyramids, defined only in their cephalic third, *a* lateral boundary is lost caudad; *b* termination vague.
2. The cross-section of the pyramids, increases with the preponderance of the hemispheres.	2. No such variation determinable. If anything the reverse is noted.
3. There is always a microscopically demonstrable decussation of the pyramid bundles.	3. There never is found such a decussation microscopically visible (though figured by several.
4. There is always present an inter-pyramidal fissure in the length of the oblongata *deepening* as we go caudad.	4. There is a faint sulcus, either equally deep throughout or *becoming obliterated,* as we pass caudad.
5. In cross-section, the boundary between the pyramid bundle and the neighboring olivary fibres is distinct.	5. It is indistinct.
6. In cross-section, the true pyramid is not crossed; that is, intersected and subdivided by trapezium fibres.	6. It is so sub-divided and intersected.

The demarcation of the calf's pyramids is correctly rendered in Gall's Plate III. In the sheep's there are some quantitative differences. The column which is, perhaps, unified externally in the bovine animals, is distinctively sub-divided in the sheep. A slender, cylindrical bundle, which runs the entire length of the oblongata, from the post-pontile border, and is of equal diameter ($1\frac{2}{10}$ millimetres) throughout lies adjacent to the basilar sulcus. Laterad of it, a slightly wider breadth is situated; this less distinct caudad than the other, and contains the olivary elevation. The latter is so beautifully marked in bichromate of potash specimens that it appears visible in all its anfractuosities, but slightly veiled by the over-lying fibres—indeed, one detachment of the olive causes a pearl-like elevation just laterad of the margin of the latter. In addition to the two bundles which represent the single columns of the ox, there is a fine curved ridge on the lateral field which courses from the trapezium to the altitude of the basilar inflection. Regarding those of both sides together they first converge in a sweep which is convex inwards, then they diverge in a second ventral sweep, which is concave inwards. There is thus formed a lyre-shaped figure, of which the trapezium constitutes the upper cross piece, while the pseudo-pyramids and the slender mesal fasciculi form the chords.

Not being in possession of an unbroken series of microscopic sections of the sheep's or ox's brain, I am unable to declare positively that *no* fibres from the so-called pyramids enter the lateral columns of the cord. I am, however, able to assert that none do so *macroscopically.* The decussation ordinarily termed the decussation of the pyramids in the hoofed animals, is now no longer known by that name. It is regarded as the decussation of the "inter-olivary layer" (Flechsig, Spitzka and Monakow) and termed the fir-cone or piniform decussation by the writer. Clarke (*vide ante*) correctly appreciated that it was homologous with what in his day was known as the upper (cephalic) or fine bundled decussation, and which the patholo-gical observations of Meyer and Spitzka have shown to be related to sensory, and possibly muscle-sense, conduction.

There is an outline resemblance between the cross-section of the oblongata of an embryonic human being prior to the development of the pyramids, and the *adult* ungulate brain. The main stress in the evolution of the latter seems to be laid on the enlargement of the internal accessory olive, in the primates and carnivores it is the V shaped main nucleus that becomes largest and most complicated.

In the elephant, the roots of the hyperglossal nerve occasionally cut through the olive, a large proportion insinuating themselves between the external accessory olive and the main nucleus. The fibre mass, ventro-mesad of the olivary nuclei in sections, is more powerful than in the ungulata (Fig. 21), but that it is not the pyramid tract is conclusively shown by its continuity with the mesal division of the lemniscus, the absence of sagittal fibres in the caudal half of the pons, and the absence of a pyramid decussatian. In no other animal, not excluding the porpoise, do I find such a deep chasm behind the pons. This is due, first to the thickness (depth) of the transverse fibre mass of the pons proper; second, to the blunt termination of the olivary masses immediately caudad of the pons. There is thus a rapid falling off of the surface before and behind.

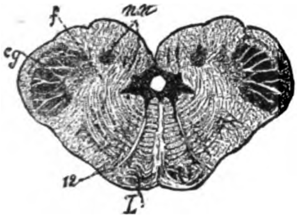

Fig. 21.

A section through the pons of the porpoise shows the tegmentum to be three and a-half times as high as the transverse fibre mass. This is partly due to the development of an enormous auditory nucleus (intrinsic or subendymal nucleus, Spitzka), which is so great that the median sulcus of the fourth ventricle is sunk two-thirds of an inch, as a cleft between those of both sides. (A large mass, which in a previous article, the writer was unable to interpret with certainty, and which is remarkable for its size and ventral position, being "let in" as it were, in the situation usually occupied by the trapezium, is the extrinsic auditory nucleus). The tegmental part of the raphe is to the vertical dimensions of the transverse pons fibre mass as seven to four. The posterior longitudinal fasciculus would seem to be small unless it be regarded as distorted and lengthened parallel with the raphe. The internal reticular field of the oblongata is the largest in the animal kingdom, and appears to be recruited from one field which in the pons level lies adjacent to the raphe, and from a second, which lies laterad, and corresponds in position, to the direct thalamus fasciculus. The field adjacent to the raphe in the tegmental part of the pons is remarkable in its disposition, In all other high mammals, the proportions are those of a long, attenuated triangle; in the porpoise, of an hour-glass.

[illegible] throughout lies adjacent to the [illegible] a slightly wider breadth is situ[illegible] than the other, and contains the [illegible] so beautifully marked in bi[illegible] that it appears visible in all its [illegible] by the over-lying fibres— [illegible] olive causes a pearl-like eleva[illegible] margin of the latter. In addition to [illegible] the single columns of the ox, [illegible] the lateral field which courses [illegible] altitude of the basilar inflection. [illegible] together they first converge in a [illegible] wards, then they diverge in a second [illegible] ncave inwards. There is thus formed [illegible] of which the trapezium constitutes the [illegible] while the pseudo-pyramids and the slender [illegible] the chords.

[illegible] ssion of an unbroken series of microscopic [illegible] the sheep's or ox's brain, I am unable to declare [illegible] fibres from the so-called pyramids enter the [illegible] of the cord. I am, however, able to assert that [illegible] *macroscopically*. The decussation ordinarily termed the decussation of the pyramids in the hoofed animals, is now no longer known by that name. It is regarded as the decussation of the "inter-olivary layer" (Flechsig, Spitzka and Monakow) and termed the fir-cone or piniform decussation by the writer. Clarke (*vide ante*) correctly appreciated that it was homologous with what in his day was known as the upper cephalic or fine bundled decussation, and which the pathological observations of Meyer and Spitzka have shown to be related to sensory, and possibly muscle-sense, conduction.

There is an outline resemblance between the cross-section of the oblongata of an embryonic human being prior to the development of the pyramids, and [illegible] ungulate brain. The main stress in the evolution of [illegible] to be laid on the enlargement of the internal [illegible] the primates and carnivores it is the V[illegible] [illegible] largest and most [illegible]

In the elephant [illegible]

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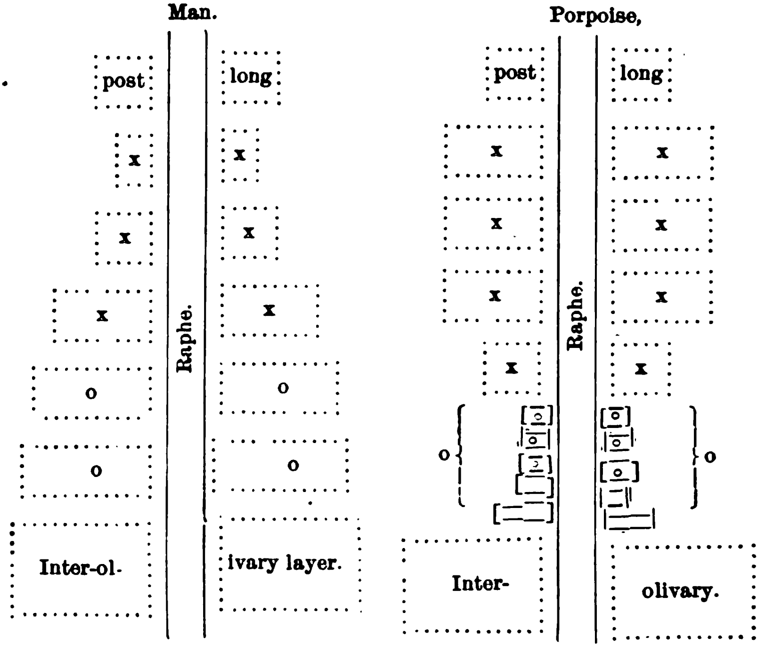

Fig. 22.

The field marked x in the diagram is the one which, according to the results obtained by Spitzka in a cat, whose thalamus was destroyed, is derived from the thalamus through the decussation of the post-commissure. That this field and the lateral (uncrossed) thalamus field should be as large in the porpoise whose thalamus is also hypertrophic, seems to indicate a relation of their fibres either to the* intricate trunk motions or the exquisite sensibility† of the porpoise. The writer inclines to the former alternative, because the fields in question pass into the anterior (ventral) columns of the cord. The

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* "Neurologisches Centralblatt" (Berlin), 1885. June 1st.

† The cutaneous pain sense is exquisite. I know naught of the tactile sensibility, which in a previous communication I had, perhaps erroneously, inferred to be blunt.

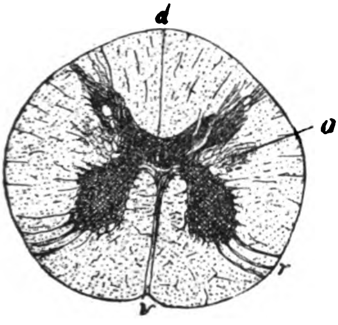

Fig. 23.

absence of a crossed pyramid tract renders the latèral, and the absence of a column of Goll, the posterior column, relatively small; the great height of the thalamus field in the anterior column is responsible for the heart shape of the cord section and the greater depth of the anterior fissure of the cord, as compared with the posterior.

Ordinarily, among mammals at least, the radicles of the sixth pair (abducens nerve) closely follow the contour of the internal reticular field of the tegmentum. In a cat, in which atrophy of this field had been induced, these radicles were deflected towards the raphe, on the side of the atrophy. In the porpoise, however, the roots descend directly, leaving an appreciable interval between them and the contracted field of the hour-glass (Fig. 23). The remarkable deficiency of the latter can be, provisionally at least, attributed to naught else than the rudimentary state of the hind limbs.*

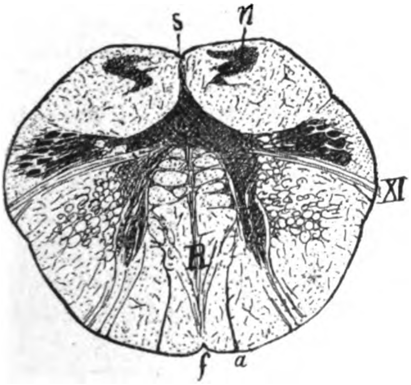

Fig. 24.

It is probably not unrelated to the absence of a pyramid that the raphe of the oblongata is attenuated ventrad, and thickens progressively dorsad (Fig. 24). In primates, carnivores, rodents and other classes, where the raphe is of equal height throughout, or if anything diminished dorsad, this is due to the derivation of its longest fibres from the pyramids. In some levels there *is no* raphe between the porpoise's olives, the olivary fibre "halo" fusing in the middle line.

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* The porpoise enjoys considerable tail motion co-ordination, in one case utilizing this member in stirring up other animals lying in the same tank of the Brighton Aquarium. In an earlier communication I stated the porpoise to be the only animal having the dorsal fissure of the cervical cord shallower than the ventral. The same state is approached by the sea-lion, and also by some ruminants.

V.—THE PYRAMIDS OF THE RODENTIA.

In 1876 Flechsig, in his great work, called attention to the remarkable relations of the pyramids in the rodentia, particularly the muridæ. It appears (loc. cit. p. 321) that a figure of the mouse's oblongata accompanying Stieda's paper first directed his notice to this subject, and I have an indistinct recollection, which I am unable to verify by my notes or works of reference, that Flechsig himself examined the rat, and found the same condition, namely that the bodies ordinarily regarded as the pyramids of these animals *decussate into the posterior columns.* The question he raises might at first appear to be a mere paraphrase of the one hinted at by Clarke, and ventilated in this paper, about the greater resemblance of the mis-called decussation of the pyramids in the horse and ungulates generally, to the decussation of the interolivary layer in man. The decussation in the rat is from powerful colnmns, with a defined inter-pyramidal fissure, which resemble in all their relations the pyramids of the first type. The decussation besides, resembles in *character* a true pyramid decussation, being in coarse bundles, and not in the delicate strands characterizing the interolivary decussation.

Flechsig, however, starting with the relations of the spinal tracts as his criterion, sweeps away all difficulties by declaring that in rodents "the bundles exposed at the ventral face of the oblongata, on either side of the median line and near the region of the pyramid decussation, are to be regarded as the interolivary layer." After a careful review of the question and a renewed study of one of the muridæ I feel compelled to regard his interpretation as unfounded.

In all the rodents named in my list, there are two columns, one on each side of the ventral fissure. They are not covered by the (very distinct) trapezium, and unlike the ungulata, their caudal ends are sharply demarcated and of definite and pointed termination. On examining a series of transverse sections * of a rat's isthmus, I found that in the pons and oblongata these columns and their prolongations have exactly the same relation as in the cat, dog and other carnivora.

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* A complete series was prepared in my laboratory bv my assistant, Dr. Mollenhauer, with special reference to this inquiry.

	RELATION TO THE DECUSSATION.	RELATIONS IN THE OBLONGATA.	RELATIONS TO THE TRAPEZIUM-FIBERS.	RELATIONS IN THE PONS VAROLII.	RELATIONS IN THE CRUS CEREBRI.
Pyramids in Man and Carnivora.	Pass into opposite lateral col'm chiefly.	Situat'd ventro-mesad of olivary nucleus; more ventrad than mesad.	Lie ventrad of the trapezium fibres.	Pierce the transverse fiber mass and are separated by an appreciable interval fr'm the *ligne de separat'n.*[*]	Continued into the *Pes.*
The columns in question in the Rat.	Pass into opposite posterior col'n chiefly.	"	"	"	"
Interolivary layer in Man and Carnivores	Pass into opposite posterior column.	Situated mesad of olivary nucleus.	Lie dorsad of the trapezium fibers.	Do not pierce the transverse fiber-mass and lie dorsad of the *ligne de separation.*	Continued in the *tegmentum.*

Here we have of five characters, four in favor of the true pyramid nature of the questionable tract of the rat, and only one in favor of Flechsig's interpretation. If the rat had no other interolivary layer, the latter view might seem less conflicting with the facts. But the rat has a true interolivary layer in the usual situation, in addition to the questionable tract. Furthermore, a few, though distinct bundles, do pass from the decussation of the latter into the opposite lateral column.

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[*] So named by Gall. It is the sharp connective tissue intercalation, which separates the true pons—that is, the transverse fiber mass—from the tegmentum.

This refutation of Flechsig's revolutionary views does not rely on my own observation alone, for Vejas and others in their representations of the rat's and rabbit's isthmus, delineate both distinct pyramid and interolivary tracts.

The writer believes that position in the crus, pons, trapezium and oblongata should be regarded as the true criteria of the homologies of the pyramid tract. Where an anatomical structure is variable in some respects in the zoological series, we seek for its unvarying features in order to establish its homologies. So far as pyramid tracts can be identified in the animal scale, they occupy homologous relations in the crus, pons, trapezium and olivary region, but variable relations in the decussation. Consequently, we must regard the constant relations as our guide. Under this guide we find that the rodentia have true pyramids, which in some forms decussate into the posterior column, just as the frugivorous bats have true pyramids, which decussate on the surface of the brain, cephalad of the usual situation, and without any connection with the raphe; in other words, differing in every possible respect from the decussation which we have come to regard as the typical form.

The connection of the true pyramid with the posterior column in the rodents named, suggests the possible existence of a closer phylogenetic relation between the pyramid tract and the posterior columns than on first sight appears plausible. We see that one and the same tract may pass into the posterior columns or into the crossed pyramidal tract, accomplishing the former in the muridæ, and the latter in the typical forms. The decussation of the interolivary layer is to be regarded as the primitive decussation, whose path was used at a subsequent period by the, functionally-speaking, higher pyramid tract as a guide. Is it to be wondered, then, that in one animal form we should have a transition stage become permanent; that is, a tract which above the decussation is a true pyramid, and below it passes in great part into the posterior columns? Even in man and the carnivora exist fibre admixtures between the interolivary layer and the pyramid tract, not to speak of the cephalic anastomosis through the bundle which passes from the pes to the tegmentum, and whose existence I must maintain as a clearly demonstrable one against several modern writers. Perhaps the older writers builded better than they knew when they called the slender columns of Gall the "posterior pyramids." Perhaps we may yet see ourselves compelled to return to the nomenclature of Meynert, which is based on the assumption of an upper (cephalic) and a lower (caudal) decussation of the pyramids. There would then be established an interesting series of transition forms in which these two intellect tracts would be shown to present relations partly of mutual support and parallel development, partly of a vicarious character.

Aside from the morphological suggestions which this subject opens up, I feel sanguine that a renewed study of the comparative development of the larger tracts will lead to important physiological conclusions. These, I think, can be framed somewhat in this way: First proposition—the elephant and the porpoise agree in having no pyramid tract; what function is equally, or nearly so, reduced in both? Answer—Elective motion of the antibrachium and digits for any other purpose than that of ambulatory and natatory locomotion, is limited or impossible in both. From this proposition the inference would be drawn that the pyramid tract is the prehensile, *i.e.*, digital controlling motor tract. In all the other ungulata, we find that part of the pyramid tract, which decussates in the typical form, absent; for those animals, elective digital motion is also limited or impossible; so that the case of all the hoofed animals sustains the inference derived from the case of the elephant and the porpoise. But so far, the proposition is merely sustained by negative facts. Let us now examine the animals who have elective digital motion, and we find that step by step, as this motion becomes more elaborate and more subjected to the higher intelligent needs, the pyramid tract is relatively enlarged.

But we are aware that the elephant possesses a co-ordinating power, as far as maintaining the erect position, balancing himself on rolling barrels, and other feats are concerned, which in kind is very like that enjoyed by the human being. His sense of weight, pressure and resistance is also highly developed. The question then arises, has the elephant any tracts which are commensurately developed with those of man? Answer, the interolivary layer and the transverse fibre mass of the pons. Inasmuch as the function of the interolivary layer is determined by other methods to be that of conveying the muscular sense, we should infer by exclusion that the pons fibres were concerned with the power of balancing the body in space.*

Table showing proportionate development of the brain as compared with the cord, and of the pyramid tract in the Carnivora and Primates.

Species. †	Cubic area of the entire brain (encephalon) in cubic millimeters. The measurements made in cubic centimeters originally, and then changed to millimeters.	Square area of uppermost cervical cord in millimeters.	Proportion of square area of cervical cord to cubic area of brain in millionths.	Square area of pyramid far above the decussation in millimeters.	Proportion of square area of pyramid above decussation to the area of the cervical cord in percentage.
Man (*a*)....	1,620,000	81	50	33	40:100
" (*b*)....	1,015,000	70	68	24	34:100
Chimpanzee	347,000	$49\frac{50}{100}$	412	12	24:100
Sea-lion...	488,000	97	918	17	17:100
Sun Bear...	216,000	$46\frac{50}{500}$	217	—	—
Leopard....	95,000	$50\frac{75}{100}$	534	$1\frac{5}{10}$	6:100
Fox......	41,000	25	634	—	—
Opossum...	10,000	$10\frac{50}{100}$	1050	—	—

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* Although the surface extent of the pons is great in the porpoise, its depth is very slight and not one-fifth part that of the elephant. As the pons fibres, in great part, course to the frontal lobes, the deficiency of the latter in the porpoise harmonizes with the relative atrophy of the corpus striatum and the pons fibers. In order to make a porpoise's hemisphere, cut away the greater part of the frontal half of the elephant's hemisphere, attenuate the remainder and tilt the whole forward.

† All measurements are taken from the hardened brain; the different specimens having been hardened in the same fluids, and preserved about the same period (5-7 years). The entire area is measured by the displacement of alcohol in a graduated cylindrical vessel; the square areas by thin glass ruled in squares.

Animals with no hind limbs (porpoises) have no column of Goll. Those with reduced hind-quarters have them of smaller dimensions (seals) than those with well-developed ones (lions and man), and the atrophy is most marked in that dorsal part of the column in which the sciatic tract is to be located.

Another example of the same kind of reasoning is afforded by the comparative study of the inner pair of those bodies which are known as corpora geniculata. And although the main facts leading us to infer their possible relation to the auditory nerve have been derived from experimental researches performed by Gudden and his pupils, yet there can be little question that an earlier careful and extended study of their comparative development would have shown the following:

1st. The corpora geniculata interna are not parallel in development with the function of vision: while the anterior corpora bigemina and the external geniculata bodies are rudimentary in the blind Syrian mouse (aspalax) and the mole, the internal bodies of the same name are represented (Forel, Goddon) in their normal proportions.

2d. The corpora geniculata interna are not parallel in development with the anterior corpora bigemina. Thus the latter are much smaller than the posterior in the seal—and the only instance so far discovered among the carnivora—the internal geniculata bodies are much larger than they. They are as large in no other animal.*

3d. The optic nerve is very small in the seal. A fact which shows that largeness of the ocular globe is not necessarily related to acuteness of vision, which is also illustrated in the case of certain crepuscular animals.

4th. The auditory and trigeminus nerves are the two preponderating cranial nerves in the seal, and it is plausible in the absence of contradictory facts, to believe that the internal geniculata body has a functional connection with either of these nerves. But, inasmuch as other animals with as powerful, or nearly as powerful, trigeminus nerves, show no commensurate development of this body, by exclusion we may regard it as an auditory ganglion.

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* That is of those named in the list, and not marked by asterisks. Since the porpoise has a still greater disproportion of the bigeminal bodies, the posterior being very large, it is possible that still larger inner geniculate bodies occur with this species, in harmony with the observed fact that they keep step in development throughout the mammalia.

This theory, which was within the reach of earlier comparative anatomists, but which they failed to recognize, receives support of a far stronger character from the followers of Gudden's method. They have shown that this body is directly connected with the auditory field of the cerebral cortex in dogs (V. Monakow) and the fascicular mass connecting them, already imperfectly known to Gratiolet, is found on the ventral part of the posterior-most part of the internal capsule. It is in perfect harmony with this, that the region of the seal's cerebrum, which corresponds to the dog's auditory field, is so hypertrophic that the horizontal branch of the sylvian fissure is crowded cephalo-caudad, as in no analogous type. As also in no other thoroughly examined form, a beautiful fluted fasciculus is seen on the ectal and dorsal border of the internal geniculate body. Since the auditory nerve, the inner geniculate body, the coronal bundle from the latter, and what homology suggests as the auditory temporal field, are all extraordinarily well developed in the seal, the experimentally obtained facts of V. Monakow receive a strong support. At the same time, the case of the seal shows that it is only a special field of the temporal lobe that has auditory relations, for the apex of the temporal lobe is, in this animal, atrophic.

VI.—RELATIONS TO THE HYPOGLOSSAL NERVE ROOTS.

The emerging roots of the twelfth pair are no criterion of the boundary of the pyramids. It is true that in man these roots normally pass out in the sulcus between the lateral edge of the pyramid and the olivary eminence. But we would be reduced to absurd conclusions were we to call every fasciculi lying mesad of the hypoglossal roots the pyramids, and to deny olivary eminences to those animals, who have no olive-like body ectad of them. In the subjoined list examples will be seen of every possible mode of exit on the part of the motor nerve of the tongue—not excluding one instance where its filaments lie mesad of the pyramid bundles (Pteropus). In most animals they pass ectad of the olivary eminence, if there be one, so that the latter intervenes between the roots and the pyramid. This fact had puzzled Wilder, who, limiting his examination to the surface characters, named the laurel leaf shaped olivary field of the cat the area elliptica, thus indicating a reservation as to its significance. Older writers made some wild statements on this very head. Thus, Solly, although elsewhere (*vide ante*) manifesting powers of independent observation, approves the following, cited from Cuvier's "Leçons": "The olivary bodies are very distinct in the apes: but in some carnivores, as in bears, they are not so well formed; in others, as the lynx, badger and seal, the internal border is confounded in their whole length with the pyramidal bodies, and only distinguishable by the origin * of the twelfth pair of nerves."

A series of transverse sections shows that nothing is so inconstant as the relations, not alone of the exit, but also of the intra-medullary course of the twelfth pair. However excellent guides, certain nerve roots, such as the eighth, fifth, and the lateral mixed system, are for the searcher of homologies, the hypoglossal nerve is certainly not entitled to rank among the number. To this fact the writer called attention over seven years ago, and every subsequent observation only served to strengthen the statement then made.

MAN AND APES—The roots always emerge in the furrow between the olive and the pyramid.

In their intra-medullary course they sometimes cut through the main nucleus, others passing between the main nucleus and the *inner* accessory one.

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* Although Solly, in blind reliance in Cuvier, falls into the error of placing roots in question between the olives and pyramids (meaning actad of the latter) on page 111, he plunges into the very opposite one on page 115, where he says, in speaking of the seal, "The corpora olivaria maintain the same central position as in the porpoise, but they do not project on the surface." Any one desirous of indulging in a, psychiatrically speaking, dangerous species of metaphysical gymnastics, may endeavor to reconcile these two statements, and attempt to picture to himself the course of the nerve as depicted in both. It must be confessed, however, that as regards the unwarrantable assimilation of the seal to the porpoise, Solly does not show to any disadvantage as compared with Meynert, who writes forty years later. Even in regard to the illusion under which his draughtsman has been stated to labor with regard to the olive of the elephant, it may be said in extenuation that an imperfect line of separation, but corresponding only to a part of the olive, exists in the place indicated in so exaggerated a way.

Seal— The roots emerge *from* the olivary eminence[*] itself.

Sea Lion, Carnivora generally, and most mammals not otherwise specified— The roots emerge laterad of the olivary eminence.

In their intermedullary course they pass clear of but close to the *outer* accessory and main nuclei.

Elephant— The roots emerge laterad of the combined olivary and inter-olivary tract elevations.

In their intra-medullary course they cut through the *outer* accessory nucleus where it represents a lamina on cross-section, and where it is round on cross-section, they imbed it as a a stone is held in a sling.

Porpoise— The roots emerge laterad of the olivary eminence.

In their intra-medullary course they run clear of all the olivary nuclei.[†]

Pteropus— Emerges laterad of the pyramids, and mesad of the crossed pyramid bundle.

In the intra-medullary course, it cuts through the outer accessory olive.

Parrot— Emerges in a situation homologous with that of the edentate, ungulata, etc.

In its intra-medullary course, it occasionally cuts into the outermost edge of the olivary lamina.

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[*] This is the only instance of such an origin in my experience. The difference in the surface development of the olivary eminence in the seal and sea lion is remarkable, considering the near relationship of the two groups.

[†] The outer (dorsal) accessory olive of the porpoise resembles that of the elephant, the main and inner (ventral) nuclei—those of the hippopotamus, being folded with closed folds. The hypoglossal nucleus is a peculiar one in location and appearance. It is insular, removed from the typical subendymal situation, and appears to correspond rather to what in my paper on the mechanism of the brain I considered the hyoid nuclear centre. In the seal the posterior (hyo-muscular ?) rootlet of the hypoglossal is relatively as large as the cephalic rootlets are slender.

In including a non-mammal in the above list I have been actuated by the following reasons: First—The parrot is the lowest vertebrate in which a true olivary body has been demonstrated.* Second—It would lead to the strange conclusion that the hypoglossal roots emerge in the lowest forms, exactly as in the highest; that is, mesad of the olives, if Clarke's mistaken homologization of the olives in birds be allowed to pass unchallenged, Clarke speaks of a scattered mass of cells as the representative in birds of the olive of mammals, and describes their situation thus: "the cells are small and not arranged in a lamina, but scattered through the sides of the anterior column." In the parrot (ara and trichoglossus) a distinct deeply staining lamina is found, not "at the side" of the anterior column, but on either side of the raphe, with which it all but comes into contact, and from which it extends ectad, parallel with the basilar contour of the oblongata. It is richly provided with such cells as characterize the inner accessory olive of mammals to which, as found in lower forms, it corresponds, both in structure, situation and relations. The scattered group of cells seen by Clarke are present in addition, but it lies ectad of the powerful hypoglossal root, exactly as in other birds, and bears the same relation to the parrot's true olive that the nucleus antero-lateralis of Clarke bears to the olive of mammals,

The resemblance between the section of the sheep's medulla represented in Clarke's figure 14 of plate XII ("Philosophical Transactions," 1858) and that of the parrot is sufficiently great to tempt the homologizer, the outline of the olivary mass, the hypoglossal nucleus, the passage of the hypoglossal nerve and the situation of the nucleus antero-lateralis is exactly the same in both. It is, therefore, remarkable that Clarke should mistake the nucleus, which he was the discoverer of (in mammals) for an olivary nucleus in birds. The facts are these: the parrots alone, of examined birds, have a true olive; all birds, including the parrot, have a nucleus antero-lateralis, which was erroneously regarded as the representative of the olive by Clarke.

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* By the writer in several articles, beginning with the "Olivary Body in Man, Anthropoids and Lower Mammals."—*Journal of Nervous and Mental Diseases*, 1878.

It would be interesting to determine whether other talking birds have the same olivary nucleus as the parrot, in accordance with Schroeder Van der Kolk's theory, or whether, in harmony with the author's supposition, the "dawn" of olivary development coincide with the dawning prehensile sense of the parrot's claws.

RECAPITULATION.

1. The presence of symmetrical columnar eminences on either side of the ventral sulcus or fissure of the oblongata is a characteristic feature of the mammalia as a group. While it has become customary to designate these eminences as pyramids, this designation should not commit us to regarding them as the morphological or physiological homologues of the pyramid tract of man and the carnivora. No less than three different anatomical elements may singly or in their combination produce these elevations: First, the true pyramids—man, carnivores, rodents, bats; second, the interolivary layer—elephant; third, the olives—porpoise.

2. In probably all edentates these columns are so faintly marked as to be scarcely identifiable (sloth, armadillo).

3. In the elephant and porpoise the pyramids are demonstrably absent, as an expression probably of the physiological characters of these animals.

4. Among the remaining mammalia two different types of olivary development are found, which closely follow the zoölogical subdivisions. In the first type—primates, chiroptera, carnivora, rodentia—the pyramids are bulky, and extend as coarsely demonstrable bundles, the entire length of the oblongata, and decussate as coarse bundles into the opposite half of the cord. In the second type—ungulata—they are small in proportion to the brain, do not extend as coarsely demonstrable bundles, the entire length of the oblongata, and being apparently exhausted in supplying the cranial nerve nuclei, do not decussate as bundles into the opposite half of the cord.

With those animals having typical pyramids, the cerebral portion of these tracts has the following constant characters:

a. It is connected with the so-called motor-fields of the cerebral hemispheres.

b. Runs behind the knee of the internal capsule.

c. Forms a part of the pes pedunculi.

d. Pierces the transverse fibre mass of the pons.*

e. Is separated by an appreciable interval from the inter-olivary layer while in the pons.

f. Runs ventrad of the trapezium.

g. Runs ventro-mesad of the true olives.

h. Decussates grossly into the opposite half of the spinal cord.

6. The decussation of the true pyramids exhibits three different types

In these two types the decussation represents a hypertrophy of the raphe.	A. The common type, the great mass of each pyramid passing into the opposite lateral column of the cord—primates, carnivores, some rodents. B. The great mass of the pyramids passes into the opposite posterior column—muridæ, cavia (less pronounced).
In this type the raphe has no connection with the decussation.	C. The pyramid decussates on the surface of the brain, and passes into the lateral field of the oblongata—frugivorous bats.

7. Among animals presenting the type A the pyramids are an index of the preponderating influence of the higher centres, and this is made manifest by two factors: First—the relative area of the trans-section of the pyramid; second—the crowding of the olives from a deep mesal situation to a more lateral and superficial one.

1st—The relative area of the pyramid tract in the oblongata increases in the order of intelligence, but this is true only for animals of the first type.

2d—The prominence of the olive—partly due to its intrinsic development—becomes more marked, as we pass up in the scale of pyramid development.

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* Inasmuch as the transverse fibre mass, through its intercalated nuclei, gives off brainward fibres, it is only the caudal half of the pons in which this criterion of the pyramid tract is to be sought for. The remarks about the elephant's and porpoise's pons relate only to this portion.

8. Among the same group of animals there are instances where the pyramids are larger with bulkier species; thus, they are proportionately greater in the lion than in the leopard, and in the leopard than in the cat; larger in the bear than in the coatimundi; in the baboon than in the cebus. This fact seems to be in relation to the greater preponderance of the isthmus, as a whole, in larger species.

9. There is no parallelism in the mammalian series between the development of the transverse fibre-mass of the pons and the pyramids. The elephant has the largest transverse fibre mass in the series, but it has no pyramids.*

10. There is no parallelism between the development of the pyramids, and the degree to which the trapezium is concealed by the pons. This concealment is complete in the elephant and partially so in the porpoise, but neither of these animals has a pyramid in the oblongata.

11. There is no parallelism between the development of the olive and the pyramid. Both are fairly developed in the above species, though the pyramids are absent. But in animals of the same type (first type, class A) there is an approach to such parallelism, in that the U-shaped nucleus dentatus is larger with larger pyramids, and becomes convoluted with the highest forms.

12. Animals with a well-developed pyramid have a wider basilar raphe than those without such; the extreme type of the latter (porpoise) having practically none.

13. It is due to the atrophy and disappearance of the pyramid tract in the series ungulata—cetacea, proboscidea—that the transverse axis of the olivary body becomes horizontal, so that the relation of the three olivary sub-nuclei, which in man is that of ectal, main and mesal, is in these animals dorsal, main and ventral. To this general rule the elephant offers an exception, owing to the vicarious development of the inter-olivary layer in the place typically occupied by the pyramid. In all ungulata the type of the olive is the same.

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* In human monstrosities lacking the pyramids, the pons is often fairly developed as far as the transverse fibres and nuclear intersections are concerned. The same applies to the olives.

14. The true pyramid always courses, in greater part, ventrad of the trapezium; the inter-olivary layer always passes through or over the trapezium, and where the trapezium is defective, as in man, in the homologous situation, which can be easily identified.*

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* In his thesis, which corroborates in the main my observations in a case of secondary degeneration of the inter-olivary tract, Schrader misconceives my description of the relations of this tract to the trapezium, evidently on the assumption that it is as marked as in the lower animals, or found in more cephalic levels. The results of v. Monakow, in this respect, obtained on a cat, agree with my description.

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* The author desires to call attention to an omission in the bibliography of the subject indicated in the title of this paper. In Vol. V. of the "Archiv. für Psychiatrie," Westphal describes a case of *ascending degeneration* of one interolivary layer; at least, so I believe, it should be regarded, as the piniform decussation was primarily destroyed.

† For several of the above references (those marked with an asterisk), I am indebted to citations from Burdach's mentioned work, and Tarini's "Adversaria Anat."

ART. II.—TUBERCULOSIS FROM ANATOMICAL, ETIOLOGICAL, AND PREVENTIVE STANDPOINTS, WITH ESPECIAL REFERENCE TO PHTHISIS PULMONUM.*

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THE HISTORICAL DEVELOPMENT OF THE VIEWS WITH REFERENCE TO TUBERCULOSIS.

Before entering upon the discussion of this very interesting question, the salient points of which we shall only be able to touch upon, it is necessary that we come to an understanding as to what is at present accepted as the meaning of the words tubercle and tuberculosis. Of necessity the two need have no connection with one another. That tubercles can develop in the lungs of an organism without being followed by phthisis is well known. According to the modern school of bacterio-pathology it is asserted that all forms of pulmonary phthisis are tuberculous. The word "tubercle" is specific with reference to the limitations of size and form only. The word "tuberculosis" is limited to an etiological conception.

Tubercles may be met with at times in almost every organ, but more especially in the lungs of almost every form of animal life. What is at present termed genuine tuberculosis is limited to the anthropomorphic and bovine species in the first place, and secondly, to swine. It may be transmitted however, to almost every form of warm-blooded life. The tubercles so frequently met with in the organs of a large number of our domestic, as well as wild animals, are almost invariably due to the irritative action of some animal parasite, or occasionally to some inanimate foreign material. A very marked development of tubercles is frequently seen in actinomycosis. It is, therefore, evident we should not use the word tubercle without a qualifying adjective, except in a morphological sense. Nodulus and tuberculum should be identical in meaning now as formerly.

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* Read before the Mass. Veterinary Association at Boston, 1885.

They have reference to form, and were only used in that sense by the fathers in medicine, the same as they used the words polypus and fungus. It was but natural that early observers should find their attention chiefly attracted by the morphological appearances of neoplastic productions. The fathers, however, used their powers according to the light that was given them, and did not limit their descriptions to morphology alone, but also gave consideration to the density, color, contents, etc,, of such products. So far as the eye could see, or the hand feel, they described quite correctly; hence we frequently read of a "Tuberculum scirrhosum," or "durum," or "scrophulosum," as well as of polypi or fungi of the same nature.

Neither form, consistency, nor color are, however, characteristics upon which we can place any great value with reference to the elementary structure of neoplastic products. From the etiological point of view such macroscopical phenomena are valueless. Hippocrates and the earlier Greek writers frequently used the word "Phymata" to characterize the same thing for which their Latin successors used "Tubercula;" but neither of them applied either word to the noduli to which modern usage applies the word "tubercle." On the contrary, these words were used indiscriminately for almost every variety of circumscribed product, abscesses, bubos, hypertrophied glands, tumors, etc. Sylvius, 1680, appears to have been the first observer that described anything which bears any morphological resemblance to the existing ideas of tubercle. Things remained "*in status quo ante*" until the birth of the analytical school of medicine, through the agency of Bichat, in the latter part of the last century in France. The advancing minds of this school soon found themselves in a hot fight as to what was tubercle, what tuberculosis, and what scrofulosis. Bayle and Baillie were among the first to enter the pathological arena, but the Bayard among these medical knights was undoubtedly the father of pulmonary pathology, the genial and immortal Laennec.

Laennec by no means differentiated the tubercle of phthisis from other morphologically or macroscopically similar products; in fact, he seems to have almost entirely ignored the existence of the tubercle, *per se*, in phthisical processes, and to have given his attention to the terminal result in such processes, viz., caseation. In his writings we find tuberculization equivalent to caseation—tubercular infiltration and scrofulosis all treated as one and the same thing. The tubercle owed its origin to a scrofulous diathesis, without which it could not develop. At this time we find the writings full of discussions as to what was "Scrofel-stoff" or "Tuberkel-stoff," and whether they were identical materials or not. The views of this period, somewhat modified by time and experience to be sure, are very well expressed by Sir Robert Carswell in his atlas. He says:

"The term Tubercle is employed to designate a peculiar morbid product which pathologists describe as occurring in various organs in the form of a small round body, said by some to consist at first of a firm, gray, somewhat transparent substance which afterwards becomes opaque and of a dull yellow color, and may then be broken down between the fingers like a morsel of cheese. These characters are said to represent what is called the first period, or true tubercle. At some subsequent, but indefinite period, the crude tubercle loses its primitive consistence in virtue, it is believed, of certain inherent properties by means of which it is converted into a liquid mass, of the consistency of cream." It is further stated that, " this process, which constitutes the period of softening, is perceived always to take place in the centre of the crude tubercle, and proceeds from thence to the circumference."

Andral, in particular describes the tubercle at its origin, as a pale yellow opaque small round body of various degrees of consistency, and in which no trace of organization can be detected. He denies that the gray semitransparent corpuscle, or granulation, as described by Laennec and since by Louis, constitutes the primitive state of the tubercle, or that the process of softening takes place invariably in the centre of this substance. The latter changes he ascribes to the admixture of pus, secreted by the tissues subjected to the stimulus of the tubercle, as a foreign body, and not to any change originating in the tubercle itself. He conceives a correct definition of tubercle, or rather of tuberculous matter, which constitutes the essential anatomical character of those diseases to which the term "tubercular" is now so exclusively credited, to be as follows: Tuberculous matter is a pale yellow, or yellowish gray opaque unorganized substance; the form, consistence and composition of which vary with the nature of the part in which it is formed and the period at which it is examined. The prevailing opinion among pathologists is, that the seat of tuberculous matter is the cellular tissue of organs; that it may however be formed on secreting surfaces as in the numerous follicles of the intestines; perhaps in the air cells and bronchi; the surface of the pleura, and likewise in false membranes, or in other accidental new products, and in the blood itself, *i. e.*, may be an Exudate.

Schonlein wrote, 1832 that "the tubercle family is related to the scrofulous, but by no means identical with the same. Tuberculosis appears only in the cellular tissue, and especially in that of secreting organs. The tubercle is to be looked upon as something foreign; the organ therefore shows a tendency to throw it off. This tendency is shown in various ways according to the functional variation of the organs: *i. e.*, in tuberculosis of the lungs by means of coughing, which is not to be looked upon as a symptom of disease, but rather as an indication of the curative attempts of nature. In tuberculosis of the stomach or liver nature shows her efforts in this direction by emesis; and when the nervous system is complicated, especially in tuberculosis of the brain, by convulsions. Anatomically considered, we observe in the tubercle a nucleus and an enclosing membrane. The latter is either formed from the compressed cellular tissue of the organ in which the neoplasm is situated, or it is a newly developed membrane taking its origin in the elements of the same. Sometimes this capsule consists of several layers; an external or vascular, and an internal. or serous membrane; a construction which reminds us of the Corion and Amnion.

"The nucleus undergoes a certain cyclus of change, which we call tubercular metamorphosis. In the beginning it is more or less transparent and is composed of a sort of gelatinous mass. Later on it becomes clouded, under conditions which are to be compared to yolk development in the ovum of lower animals. This cloudiness gradually extends in a radial direction towards the peripheries until the entire tubercle loses its transparency and is transformed into a mass of fatty detritus. According to our present knowledge every tubercle is at first a cyst, 'Blase,' filled with gelatinous fluid and of a roundish form."

Henle, 1847, speaks of the "tubercle as an organized formation. These bodies which are sometimes looked upon as a raw product, consisting of a blastema incapable of further development, and at others as malignant products having peculiar vital characteristics which justifies their classification with parasitic neoplasms, are neither the one or the other, but are bloodless, necrobiotic lobuli which remain in connection with the healthy parts. They are filled with epithelial elements, or with pus cells, granular conglomerates and granular cells that have suffered disturbances in their regular course of development, and have been conserved in a desiccated condition with the substance in which they are enclosed. We place a certain value upon the form, from the ontological standpoint, when the tubercle appears as a regular attribute, and at the same time as a distinguishing characteristic of a parasitic organism."

It is worthy of note that Bennett, 1842, mistook the fibrils forming the stroma of the tubercle for vegetable fungi, and described them as such.

Rokitansky was, in his earlier days, a literal follower of the Laennec school, and looked upon tubercle material as an exudate, but later (1855), describes the tubercle as "distinguished by its inclination to desiccation, with consecutive destruction of the tissues in which it is situated, on account of the high degree of development in its elements. The tubercular mass is a gray, semi-transparent material of a pearly color, or a yellow, opaque product. There is no doubt that this is a secondary stage of the originally gray-appearing elements. This metamorphosis is however not peculiar to the tubercle mass alone, but occurs also in other cellular and nucleoid products."

Burckmueller describes the tubercle "as a neoplasm, made up of lymph cells, which assume a nodular form. These noduli seldom attain the size of a millet seed; they are soft, of a grayish-yellow color, and consist of a densely accumulated mass of cells, without any intercellular substance; these cells are colorless and have a somewhat granulated plasma with divided nuclei; towards the peripheries of the nodulus we often find larger cells with several nuclei which resemble pus cells, as well as very large masses of protoplasma, with numerous nuclei (giant cells). The most common metamorphosis which the tubercle undergoes is caseation to which authors have previously given the name of 'Tuberculisation,' wherever met with. The tubercle is to be looked upon as a malignant neoplasm, because it has the ability to extend to juxtapositional tissues and to cause the ulcerative destruction of the same. The softened tubercular detritus often causes a species of infection which may lead to death by inflammatory processes in the lymphatics and lymph glands, and the accumulation of lymph cells (leucocytes) in the blood and metastasis."

It must be evident that it was largely through the influence of the Laennec school that the idea of the identity of scrofulosis and tuberculcosis obtained so great an authority and such a wide extension among pathologists. It remained for Virchow to show that caseation frequently occurred as the final result under conditions, and in connection with processes, that had neither an anatomical nor etiological connection with tuberculosis. He demonstrated that caseation was a deuteropathic, following upon a protopathic, or formative condition, and was, indeed, the gradual and incomplete death—Necrobiosis—of the cell-elements of a large variety of neoplastic processes. He taught that the genuine opalescent was the only true or vital tubercle, while the opaque, cheesy degenerated nodulus, was no more a tubercle but a dead mass. He drew the sharpest distinction between scrofulosis and tuberculosis, and insisted that either could occur entirely independent of the other, though the first might act as a predisposing cause to the second, or might owe its existence to constitutional conditions which, under other circumstances might lead to tuberculosis. He also differentiated very sharply between caseous bronchitic conditions, caseous pneumonia and tuberculosis, looking upon the tubercle as the result of the specific irritation of an unknown quantity (agent), upon the connective elements of the lungs. He asserted that, while a tubercle could develop from the connective septa into the lumen of an alveolus, and appear as a caseous plugging of of the air cell, still that it was not paranchymatous in its origin in a strict anatomical and genitive sense. He admitted that in the beginning tubercular conditions bore the strongest resemblance to those of caseous pneumonia, but asserted that miliary caseous broncho-pneumonia, in its first stage, could always be distinguished from miliary tubercular phthisis.

A point which must not be passed over was a "child of the period," the doctrine of specific tubercle cells or bodies; the "Tuberkel Körperschen" of Lebert. At the same time we may read detailed descriptions of all sorts of specific cells, such as those of glanders, cancer or syphilis. Such specific cells do not exist. The abnormal appearance, arrangement or position of cells is what constitutes anatomical or physiological specificity. All neoplastic cells are the derivatives from their normal, embryonal prototypes.

The idea of specific cells in tubercles again found expression in connection with the so-called "giant cells," to which we shall presently refer.

Virchow denied an inflammatory origin to the tubercle, as well as that it was an exudative product. This is about the condition in which Virchow left the tubercle question, and conforms to his present teachings from the anatomical standpoint.

I have previously alluded to the fact that the "giant cells" in tubercles were looked upon as pathognomonic objects. Virchow mentioned their occurrence in tubercles, but Langhans first studied and accurately described them so that they have frequently been spoken of as "Langhans'-cells." Their specificity is at present denied by most authorities, but the conditions of the question will be best shown by a few quotations.

Birch-Hirschfield says of them: "The endeavor to make the 'giant cells' a necessary element of the tubercle has been generally contradicted. The extensive multinuclea masses of the protoplasm, which we call 'giant cells,' occur under a great variety of conditions. Physiologically they appear as an element in bone-structure, and again where osteoid tissue is subject to resorption; in the uterine sinuses; in inflammatory products in experimental peritonitis; in the alveoli of the lungs in chronic pneumonia; in syphilitic inflammations and hyperplastic lymph-glands, and in certain tumors."

Herring, Ziegler, Perls, and others, all give similar testimony. Ziegler has seen them develop in connection with other cells between two thin pieces of glass, forming a capillary space when introduced into the sub-cutis.

Weigert* says: "They deserve the name of 'giant-cells,' not only on account of their size, but on account of their multinucleated condition. Among the varieties of giant-cells which are known to us, those of Langhans assume a peculiar position, because of the striking grooping of the nuclei which are not distributed promiscuously through the protoplasm of the cell, but have a decided tendency to accumulate towards its circumference, thus leaving the greater part of the cells free. Sometimes they form a continuous mantle, and at others a sort of necklace or belt, while at others they are collected at the poles of the cell. They are frequently oval instead of being round in form, while at other times they have a radial appearance. Although very frequently present in giant-cells, they are not to be considered as a constant, necessary, anatomical characteristic. It would be an error to look upon them as such."

It is a well-known fact that the specific bacilli of tuberculosis are present in considerable numbers in giant-cells, especially in the peripheries of the non-nucleated portion of the plasma, or in the nucleated part and between the nuclei. Weigert looks upon the bacilli, in this location, as playing an essential rôle in causing caseation of the plasma of the cell, and has noticed that, as this material becomes necrobiotic, the bacilli either die and disappear, or move to the still vital portions of the plasma. If by this he means us to understand, as he says, that the specific tubercle bacilli are the cause of cheesy necrobiosis of the cells in tubercular phthisis, then I must emphatically deny the hypothesis.

We have now arrived at a period which marks another great turning point in the history of tuberculosis. It may well be called the etiological-diagnostic or bacterial period.

Its founder is Robert Koch. Again, it will be best to let others tell us what are the existing views of this school.

Friedlander says: "Pulmonary phthisis should be classed among the forms of tuberculosis; the differentiation advocated by Virchow and Reinhardt between caseous pneumonia, caseous bronchitis, and genuine tuberculosis must still be adhered to, from the descriptive anatomical standpoint; but this point of view must be modified or dropped when we come to consider the histological conditions, more especially, however, when we take into account the etiological and practical points from which these conditions are also to be considered. The exact histological examination of the products in caseous pneumonia and bronchitis shows the same elementary composition with the so-called tubercle. In every phthisis, even in apparently non-tubercular forms, one can always find the characteristic, sub-miliary, non-vascular noduli with giant-cells, etc., which comprise the chief histological type of the fully developed tubercle."

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* Deutsche Med. Wochenschrift, Aug., 1885.

He further says: "That the daily observation of the appearance of a tubercular pleuritis in the course of a caseous pneumonia, cannot any more be looked upon as the eruption of another disease, but far more probably as the extension of the processes which had previously existed in the lungs."

The discovery by Koch of the bacillus of tuberculosis has proven to the greatest certainty the unity of these processes, that phthisis and tuberculosis are due to the same etiological unit. Therefore, pulmonary phthisis must be looked upon, in most cases, as local tuberculosis. The presence of the specific bacilli of Koch in the sputum of an individual must be accepted as conclusive evidence that tuberculous processes are developing in the respiratory apparatus.

Continuing in the same line of argument, Orth says: "In order to avoid any misconception, I wish to emphasize the fact that, when we speak of inflammatory caseous processes ("Broncho-pneumonia caseosa") and those of tuberculosis, that the difference is only of an anatomical character, for, from the etiological point of view, for which their frequent combination is evidence, they are one, and all the effect of the action of the same irritant, the bacillus Kochii, which we are enabled to demonstrate, not only in the genuine tubercle, but also in genuine caseous pneumonia. If we name this irritant "tuberculous" and the disease and all diseased changes which it produces "tuberculous," then probably all caseous, broncho-pneumonias, etc., must, in this sense, be looked upon as "tuberculous," also. In order, however, to distinguish those affections which are primarily characterized by the development of tubercles, I would prefer to call the irritant scrofulous, and the disease scrofulosis, the anatomical conditions in general scrofulous, and only that tuberculosis which is distinguished by the primary development of tubercle."

To my mind these bacterio-pathologists are assuming altogether too much in their assertions with reference to the etiological connection of Koch's bacilli with all the processes that occur in the lungs in tubercular phthisis, but more especially caseous pneumonia. Admitted that they are the cause of a specific variety of tuberculosis, I am equally certain that the bacilli are not the direct cause of the cheesy degeneration in the neoplastic cells, either in tubercular phthisis or caseous pneumonia, or that they have anything directly to do with the necrobiotic destruction of the stroma of the lung, which terminates in the formation of cavities.

In "Bronchitis verminosa" of sheep, we find there is frequently a development of tubercles having many of the morpho-histological characteristics of the freshly developed bacillus tubercle. The animals die of marasmus (phthisis) but we do not find that caseous conglomerates or cavities develop in the lungs. These tubercles undergo cheesy degeneration and calcification; sometimes they form into fibroid noduli. This variation in the terminal results in the tubercle in sheep —the same is true of the tubercle in equine glanders—has nothing whatever to do with its cause, the strongylus, but is dependent upon the physiological condition of the lungs of the animals.

There is no evidence that the artificial tuberculosis induced in dogs and animals (having no natural or acquired predisposition to phthisical processes in the lungs) either by the aspiration of pure cultivations of Koch's bacilli, or by inoculations with the same, is ever followed by anæmic destructive processes which characterize tubercular or other forms of human phthisis. Such animals perish from a general marasmus due to disseminated tuberculosis, and not from phthisis pulmonum.

Weigert's theory that the bacilli are the cause of the caseous degeneration of the plasma of the giant-cells is utterly improbable. It is an attribute of these and other cellular products in phthisis, whether tuberculous or not, to undergo caseation. The plasma of such cells in such a condition being not only dead, but desiccated, no longer offers suitable conditions for the existence of the bacilli. Hence they leave such portions of the giant-cells and go to the still vital parts of the plasma.

This condition of the plasma may also have something to do with the peculiar arrangement of the nuclei as mentioned by Weigert. They cannot find the elements necessary to their vitality in a dead and dry plasma any more than the bacilli. That the presence of the bacilli in the cells may hasten caseous degeneration and desiccation of their plasma by entering into the struggle for existence, for both moisture and nutriment is apparent, but that they cause it, is quite another thing.

It would be fully as logical to assume that these bacilli were the cause of caseation in epithelial neoplasms, inspissated pus, retentive conditions, or syphilitic gummata, as in the lungs. The fact is, that caseation is the natural physiological direction inherent in certain cellular neoplastic products under certain inherent organic conditions, which they derive from their matrix, and neither the bacillus, or the tubercle *per se*, have anything whatever to do with it. Such cells are, like the organisms in which they develop, marked with death the moment they are born. That cases of caseous miliary bronchopneumonia, in a disseminated form, can occur without necessarily terminating in either tuberculosis or phthisis pulmonum is so highly probable, that it can scarcely be questioned. The difficulty is to get autopsies in just such cases.

The constitutional weaknesses—phthisical or scrofulous diathesis in the lungs, which may primarily give nutriment to the bacilli in one case, may, in another, result in bronchopneumonia caseosa, or the latter may so augment such conditions as to open the way for the attack of the bacilli. If tuberculosis follows or complicates such a disturbance, it is certain that an exposure to contagium has taken place. It is worthy of remark that not only the bacillus-tubercle (tuberculosis) but also all pseudo-varieties take their origin in the stroma and not in the paranchyma of organs. That the bacillus-tubercle is more prone to caseation than the pseudo varieties has already been noticed. The tissues in which they develop are weak and irritable, and their products must be of the same nature. In the first place, the irritation set up by the bacilli, in the interstitial tissue of the lungs leads to a local, circumscribed, disseminated nodular interstitial pneumonia, but on account of the non-resistant nature of the tissues, and from the fact that they form the septa and walls of the alveoli, the irritation at once extends to the same and is followed by an active proliferation of their endothelial cells, which bears no relation to the same in either a catarrhal or fibrinous pneumonia. In fact, so rapid does this proliferation go on, that the transudation of serum and the leucocytic migration which occurs in other pneumonias has no time to take place before the alveolus is densely packed with this cellular product. These cells have the same constitutional tendency to cheesy degeneration as those of the tubercle, though their matrix is different. This tendency to caseation and desiccation is increased by the cells themselves, from the pressure which such a putty like, immovable mass exerts upon the delicate reté of capillaries which embrace the alveoli. This net-work, being thus compressed between the solid mass filling the alveoli, becomes bloodless, while the non-diseased yet weak parts of the lung become hyperæmic through collateral fluxion, thus offering still more favorable conditions for the extended action of the bacilli, and the development of caseous-pneumonic infiltrations. The absolute anæmia thus produced by pressure of the caseous thrombi filling the alveoli must be the cause of the necrobiotic death of the pulmonary stoma in such parts which leads to the formation of cavities.

Thus it is evident that neither the bacilli nor the tubercle, nor even the caseous thrombus filling the alveoli, cause this destruction of the lung tissue through any materia peccans in the first place, though the ichorous material frequently resulting as large cavities are formed, may finally take its part in fulfilling the programme in this sad drama of life.

Summing up, then, tuberculosis is a disease characterized by the development of visible or submiliary noduli, having a grayish, somewhat opalescent appearance, and an apparently rounded form. These noduli are composed of very delicate fibrillary stroma and small epitheloid or round cells and, in general the protoplasmatic masses known as "giant cells;"

they are non-vascular. They are largely neoplastic productions, due to the action of a specific irritant upon the stroma of an organ, discovered by Koch, and otherwise known as the bacillus of tuberculosis. That which we have described is the true or living tubercle.

When it has become yellow and opaque, *i. e.*, caseous, it is no more vital, and is then much more difficult of differentiation from other neoplastic products that also undergo cheesy metamorphosis in the lungs. They are frequently so small, in the fresh invasion of densely paranchymatous organs, such as the liver, spleen and kidneys, that, when disseminated over the organ, it is impossible to see them without the aid of the microscope. The genuine tubercle possesses another attribute which distinguishes it more or less sharply from all pseudo varieties. While the latter generally appear as pretty clearly defined neoplasms, they are also isolated productions, even though they may present themselves to the microscopic eye as in apparently appositional relation to one another, still they do not have the faculty of extending and then forming a conglomerated mass; the true tubercle has the faculty (due to the bacilli) of invading adjoining tissues and thus extending indefinitely. Aside, however, from these characteristics, and aside from all previously employed methods of histological analysis, the true tubercle is always to be differentiated from all pseudo varieties by the demonstration of the presence of the specific bacillus.

The method for demonstrating these bacilli should be known to every physician, but its importance will warrant its re-statement. There are two which have been proved to be trustworthy, and have been generally adopted. The first is known by the names of those who perfected it, as the Ehrlich-Weigert method. A mixture known as analine water is prepared by adding 5 parts of analine oil to 100 parts of aq. dest. and shaking the two well up in a test tube. Then filter into a convenient, moderately flat and not too large glass dish. To this fluid we add about 5 parts of a saturated alcoholic solution of gentian, violet or fuchsin. To examine sputum one takes a little of the floculent sediment and spreads it out as thinly as possible upon a covering glass. After allowing it to dry in the air, the glass is to be grasped with a pair of forceps and passed three or four times through the flame of a Brunsen burner or spirit lamp, the material side to be held up. This process causes the albumen to coagulate and everything to adhere to the covering glass. One should always prepare at least six covering glasses with sputum from a single patient in this way for the first examination.

To show the constancy with which the bacilli may be found in the sputum from phthisical patients, it may be mentioned that Gaffky examined the sputa from 12 different person's, 982 times in all. He found the bacilli 938 times. The coloring mixture is then warmed until the vapor is seen to begin to ascend from the surface, in any convenient way, the covering glasses having been first dropped gently and squarely upon its surface so that they float, the material side being down, or in contact with the fluid. As soon as the vapor begins to rise the glasses may be removed, or they may remain longer as one pleases. The glass is then washed off in acidulated alcohol, (3 per ct. Hcl to 100 aq. dest.) until the color, red or blue, has almost disappeared from the material Wash it next in aq. dest. The tubercle bacilli retain their color, all others that may be present lose it.

This peculiarity may be made more evident by re-staining the specimen with some contrast color. For blue, an aques solution of Bismark brown; for red a solution of methyl blue or green. No heat is required this time. The glass is simply allowed to come in contact with such a solution, material side down, for a minute or so. It is then washed in absolute alcohol, and dried on a piece of white filtering paper. It can now be examined in oil, or mounted in Canada balsam. The latter must never be diluted with chloroform, but with turpentine, and oil of cloves must not be used in connection with analine colors, cedar oil being preferable. Chlorcform and oil of cloves soon reduce the color of analine dyes.

The tubercle bacilli retain the original color while all others or any other material take the secondary. Sections of suspected tuberculosis or phthisical tissues must remain in the above mentioned coloring material, which should always be freshly prepared, for 24 hours, or subjected to a moderate heat, (40 deg. C.) for an hour or so. They are to be decolorized the same as the coloring glasses; then washed in 60 per ct. alcohol; dried—spread out on a spatulum, with white filtering paper; contrast-colored, washed again in 60 per ct. alcohol, washed again as above; then in absolute alcohol, dried again; then in cedar oil; mount in balsam.

Another method, which I prefer because the coloring material can be prepared in quantity and kept on hand, and again because it acts more rapidly, has been published by Johne.

℞	Fuchsin,	1.00
	Of a 5 per ct. solution ac. carbolicum,	100.00
	Alcohol, 75 per ct.	10.00

Filter and cork, never leave the bottle open. Covering glass specimens treated as above. Sections of tissues to be decolorized in a 25 per ct. solution of acid, sulfuricum. They color in 15 minutes without the aid of heat, which however intensifies the process and makes it more secure. Friedlander's "Microscopic Technik," has lately been published in English by the Appletons under the title: "The Microscope in Diagnosis," and is the most brief and handy book of the kind yet published.

ETIOLOGY.

In the study of the pathology of any disease we have to give our attention not only to the nature or character of the disease itself as it appears in, or upon the animal organisms, but also to consider its cause with reference to the form they assume, and also their manner of acting, and further, if vital organisms, whether vegetable or animal it is the same as to what is their manner of life, and under what circumstances they flourish, and what are opposed to their continued existence. This study of the causation of disease in a general or special sense is the Alpha by which alone we may ever hope to attain the Omega towards which all the scientific methods in medicine are tending. Not only with reference to diseases of an infectious, contagious or malarial type, but also with regard to those which we technically term "sporadic," the hygienist, the honest practitioner, and the pathologist are all anxiously working to discover means for their prevention. It is first necessary that we obtain a clear understanding of the logico-pathological meaning of the words, infectious, contagious and malarial, with reference to disease. Altogether too much vagueness exists in the minds of practitioners, and I am sorry to say of pathologists and teachers also, as to the exact philosophical meaning of these words.

Contagious diseases are of necessity infectious, but all infectious diseases are by no means contagious. All malarial diseases are infectious, but the necessities to infection are of a peculiar character. To all forms of infection an either natural or acquired constitutional predisposition is necessary. Infectious diseases fall then into three great natural sub-divisions, viz., contagio-infectious, malarial and malarial-infectious diseases.

Contagious diseases are those in which the etiological moment—the inficiens, primarily and solely develops, so far as our present knowledge and experience goes, in the organism of one or more species of the animal kingdom, having what is called a natural predisposition thereto, and never outside of it.

Such diseases, or rather some of them, may extend to other species, either by direct, accidental or experimental inoculation, while others cannot be thus transmitted.

The rinderpest, variolae, rabies, spotted typhus, scarlet, measles and above all in importance, tuberculosis are examples of this class.

Infectio-malarial diseases are the most difficult of differentiation and require all the acumen of the pathologist in order to place them where they belong.

They possess the peculiarity, that the predisposed organism must go to, or be in, a locality where the "genius epidemicus" reigns in order to acquire them, but they are not of necessity confined to such a locality, though strictly local diseases. They have this peculiarity, they attack a large number of individuals at the same time, according to various circumstances not necessary to discuss here, but the diseased individuals can act as the vehicles or transporters of the infectious principle, and convey it to, and infect other localities, but not individuals. The same is true of materials proceeding from such individuals. Examples:—cholera, yellow fever, the Texas cattle disease, anthrax and some other anthra-coid diseases.

It is my opinion that the so called "hog cholera" belongs in this group.

Malario-infectious diseases are such, by which the individual to acquire them has to be in certain infected localities, the natural conditions of which favor their development, but neither diseased individuals or any material from them act as a vehicle of conveyance either to other persons or other localities.

FEVER AND AGUE.—When we come to the study of any of these special classes of diseases, or in fact of any disease, we have to take into consideration three different varieties of etiological moments: if either one of them is wanting, the etiology is not complete and infection does not occur. These are known as the

Internal, External and Sufficient Causes—For instance: I. In cholera it is necessary that the organic or internal conditions (causes) of the individual be of such a nature as to predispose him to infection. II. If he comes into localities—external causes favorable to the support and development of the specific element—sufficient cause, by which alone the disease is produced.

We have now to make the endeavor of considering the etiology of tuberculosis from these three standpoints, but for convenience will reverse the order and discuss the external, then the internal causes, and finally the sufficient cause.

External Causes.—Under this head comes everything by which the individual is surrounded or which he assumes to himself—food, air, water—which is liable to exert a weakening condition upon the organism. One of the most essential of these is occupation.

In the following I can only attempt to give the very briefest testimony, and must leave it to your own consideration to fill up the various gaps which must of necessity be left in the argument. For evident reasons the subject of cohabitation must be treated in connection with the sufficient cause. Tuberculosis deserves not only to be classed as a cosmopolitan disease, but almost as a universal one, if we limit that definition to the possibility of infection common to the mammalia, which even extends to the feathered tribe.

No climate, land or people is free from this terrible destroyer, which is the cause of the death of at least 2-7 of all the people of whom we have any statistical knowledge. It would seem as if it were as old as man, entering the world, so far as history is concerned, with our species; it has followed it in all its migrations. Its origin is buried behind the mysterious veil that shades the hidden and silent records of prehistoric ages from our view. The cholera is as the breathings of an angel in comparison to it.

To us, in Massachusetts, it may seem strange to read that the extreme northern portion of Europe is notedly exempt from tuberculosis in comparison to the more central, or even southern portions. England enjoys a most unenviable reputation in this direction. In Asia, the high plateaus correspond to the general rule elsewhere, while in the valleys the disease prevails to a greater extent. The moist, hot climate of the lowlands and deltas are especially unfavorable. Europeans having the least phthisical taint soon fall victims to the disease under such conditions. It prevails to an alarming extent in China, though Hong Kong occupies an exceptionally favorable position in this regard. In the South Sea Islands, Australia and New Zealand the disease is not only frequent but very fatal among the inhabitants. As with these people, so with all other aboriginals tuberculosis has increased among them ever since, and in direct ratio to, their intercourse with Europeans. As has been said, "we send them Bibles and missionaries in the cabins of our vessels and disease and perdition in their holds." In the Mauritius and Isle de Bourbon it again prevails, while St. Helena, the Cape de Verds and Azores bear rather an enviable reputation. Livingston reports it as "very rare in Central Africa," while along the Gold Coast its only rival is dysentery. Algiers was at one time praised very highly for the favorable conditions it offered, but experience has shown that the reputation was entirely undeserved. The river bottoms and seacoast of Egypt tend to increase the bad reputation of such localities, while the dry lands of the interior are less afflicted. Those Arabs and Bedouins who retire to houses and villages for a part of the year are much more affected than those that universally live in the open country and tents. On the American continent it prevails to about the same extent among the European inhabitants, while the general rule holds true as to the unfortunate natives. In New England, Maine and New Hampshire seem to present a more favorable outlook than Massachusetts. According to Shattuck, who wrote some thirty years since, the percentage of consumption to the whole number of deaths from 1811–1820 was 4.8 per cent, while in 1840 it was three per cent.

The following figures have been kindly furnished me by Dr. Abbott, of the State Board of Health. · The ratio per 1000 of the living population:

1857—3.95
1858—3.84
1859—3.88
1860—3.70
1861—3.67
1862—3.42
1863—3.72
1864—3.78
1865—3.67
1866—2.50
1867—2.14
1868—3.22
1869—3.29
1870—3.43
1871—3.39
1872—3.62
1873—3.54
1874—3.28
1875—3.47
1876—3.23
1877—3.29
1878—3.02
1879—3.04
1880—3.08
1881—3.15
1882—3.01
1883—2.99

Which gives a death an average rate for 27 years from phthisis of 3.43 per cent. to the thousand persons.

The ratio of deaths from phthisis to other diseases has been:

1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.
16.57	16.44	16.05	17.41	15.72	15.79	15.56	16.14	15.94	15.71

For ten years, 16.13 of the total deaths, or about one-sixth. It has long been known that the climate of Florida exerted a powerful influence in some cases of phthisis, while the Gulf coast bears an equally unenviable reputation until we arrive at Texas; as we follow the coast along towards Central and South America it again becomes unfavorable. Wisconsin and Minnesota, and the high plateau of the Western States and Territories also present favorable localities in reference to this pest.

Temperature.—Hirsch says: That a medium temperature exerts no influence upon the frequency or extension of phthisis; the high temperature of tropical regions exerts an exactly contrary effect; this fact is not, however, so much dependent upon the excessive temperature of those regions, as upon the moisture and weaking influence of life in the tropics.

It is singular that many localities that are noted for the sudden changes of temperature that occur, are also unfavorable for the development of phthisis.

In this regard, it has been remarked that "the climate of those broad and elevated table lands which skirt the base of the Rocky Mountains is especially beneficial to individuals suffering from pulmonary diseases." The extreme northern portion of Peru, though excessively hot, is noted equally for the dryness of its atmosphere, and almost total exemption from phthisis among the inhabitants compared with the remainder of the coast.

Fourcault, Lauré and other observers have remarked that the extension of pulmonary phthisis in a people bears direct relation to the maximum humidity of the atmosphere.

Temperature of itself exerts no material influence upon phthisis.— Coolidge.

Telluric conditions exert a most important influence upon the course and frequency of these diseases; *i. e.*, the dampness of the earth is equally, if not more unfavorable than that of the atmosphere which it helps to support. The configuration of a country is what should be studied as has been already indicated.

Hygienic Influences.—It is almost too well known and authenticated a fact that the density of the population in a given territory exerts a most painful influence upon the extent and fatality in phthisis. The packed population of the poorer parts of our cities and manufacturing towns offer far more favorable conditions for the action of the contagio-infectious principle of tuberculosis than the sparsely populated country districts, where these elements are, as it were, diluted and dispersed by the more free-moving atmosphere.

The greater degree of cleanliness, the less concentrated and accumulated condition of the drainage in country districts, as well as the better moral and physical conditions of the people, must not be lost sight of in the consideration of this question. Poverty, luxury and vice are a trinity highly favorable to the action of bacillus Kochii. Again, the employment of persons in cities and manufacturing towns, by which people are confined in close, warm and dusty compartments, the too frequent want of exercise in the open air, are all of a maliferous character. Grinders' pneumonia and phthisis have become proverbial for such occupations. While the deaths in the State of Massachusetts for a term of years was but 2.09 per cent. for the whole population; for the city of Lowell they were 3.08 per cent. Strong, clean, healthful food is one of the essential preventives of phthisis among the poorer classes.

It is the duty of the State to guarantee this to them, as well as to so regulate the hours of labor, that these people may have time for recreation in the open air. It has been noticed also that phthisis was less frequent among mill operatives that lived at a distance and had their daily walks to and from their labors, than in the same number living in close proximity to the mills. Phthisis has always been noticed to increase with the increase of the population. Dr. Rush, a name distinguished in the early days of American medicine, wrote: "that it was scarcely known among our citizens who lived in the first stages of civilized life and who were known as first settlers. It is less common in our villages than in our cities, and increases in both with intemperance and sedentary habits."

Its frequency in jails and houses of correction has already given occasion to much thought by hygienists and philanthropists. Such conditions, while they do not and cannot, of themselves, produce phthisis, lead to the production of, or support, constitutional weakness and irritability of the respiratory tract, which prepare the ground for the specific inficiens of tuberculosis, or for caseous destructive pneumonias.

Bovine Tuberculosis.—Among the external causes, and certainly among the most important, is the food we eat and milk we drink, especially when the latter is the sole nourishment which we give to so many babes.

The only direct vehicle of contagious infection in this direction is to be sought in bovine tuberculosis, almost the only disease of cattle which is transmissible to man in this way. Bovine tuberculosis offers us again equally, if not stronger evidence of the value of heredity, and especially contagium, than the disease in man.

The etiological unity of tuberculosis, whenever met with in an animal organism, has been proved beyond all question. Up to within a short time tuberculosis of the milch cow engaged nearly all our attention, but since Koch has shown that the lymph cells are one of the chief vehicles by which the bacilli are conveyed over the organism, and especially since their presence has been demonstrated in the circulating blood of living individuals, the flesh of all animals in which tuberculosis is found, even in a minor degree, assumes a still graver aspect, and animal tuberculosis dare not be neglected by physicians, hygienists or legislators a moment longer. The conditions which we know as indicative of bovine tuberculosis were undoubtedly appreciated by many early observers, especially Jewish, even though they had no idea of the infectious nature of the process. Columella, 42 A. D., certainly described them. These early writers on animal diseases speak of them as nodes, ulcers and sclerotic conditions in the lungs. Chabert, Huzard and other French authors describe their macroscopic appearances very well, but had no idea of their tuberculous nature. Dupuy, 1817, was the first veterinary observer to describe tubercles in any modern anatomical sense in the lungs of animals. He is especially noted for the energy with which he advocated the tuberculous nature of equine glanders. Gurlt, 1831, considered the bovine to be equivalent to tuberculosis in man, from an anatomical point of view. He followed the Laennec school and looked upon all caseous nodules as of a tuberculous nature. Spinola defended similar views. Herring made an endeavor to differentiate between caseation and tuberculosis. He placed especially stress upon the prevalence of the latter in milch cows. Gluge was among the first to give bovine tuberculosis any very particular and critical study. He reported the disease as complicating all organs, but especially the serous membranes and lungs. Forster endorsed these views, but had no idea of the identity of tuberculosis in man and animals. Virchow, 1855, entered more particularly into anatomical study of these conditions than any of his predecessors. He adopted the word "PERLSUCHT" for the disease as an entity, which had been previously used to distinguish its appearance upon serous membranes only. He acknowledged the many resemblances between the bovine tubercle and that in man, but denied their anatomical identity, considering the former to be a lympho-sarcomatous production. From the anatomical standpoint he still adheres to this opinion, whatever he may think of the etiological entity established beyond all question, by feeding experiments, but more especially by the researches of Koch.

The first detailed description of bovine tuberculosis was given by Graumann, 1680. It is singular that this should fall in the same year that Sylvius described the macroscopical appearance of the tubercle in man. Graumann's work is decidedly clinical in its character. He looked upon it as of a syphilitic nature. It was then known, and for a long time subsquently as "morbus gallicus" or the "French disease," "Französen Krankeit." The animals were frequently described as "dicke-fat, and magere-lean—Französen." Syphilis was also honored with the same name in Germany at this time. Rühling, 1774 speaks of the endemic prevalence of the "French disease in cattle," and in 1796 said it "*was of an hereditary nature.*"

Decrees were issued by governments against the sale and consumption of the flesh of cattle having the "French disease" on account of its supposed connection with syphilis.

Helmont asserted that sodomy was its cause in cattle; for, if criminal cohabitation could cause a venereal disease in human beings, he assumed that the criminal abuse of these functions could also produce it in cows. Kersting, 1726, spoke of its peculiar hereditary character.

In 1785, the decrees against the sale and consumption of the flesh of "French cattle" were abolished by law in Prussia, and soon after in the other German States. Frenzel, 1779, looked upon the disease as contagious and hereditary, and when fully developed similar to syphilis. "The exacerbation in the sexual organs—nymphomania—causes disturbances in the same by which a materia-peccans is produced, which is taken up by the whole system."

Virchow's anatomical views with regard to the bovine tubercle have never gained universal acceptence among veterinarians. Spinola and Haubner, but more particularly Gerlach opposed them bitterly. The latter would not accept the results of micro-histological analysis as conclusive in any sense of the term, but put more reliance upon clinical and experimental experiences. He placed great stress upon the value of hereditary influences, and was the first to prove the contagio-infectious character of the milk from tuberculous cows.

The extension of Tuberculosis among cattle.—I regret to say that I am utterly unable to place before you any statistics whatever as to prevalence of this disease in American cattle. Neither the Agricultural Department at Washington, nor that of any single State has ever published any such. They are not to blame. If our legislators have not intelligence enough to draft a suitable code of veterinary police and public health laws, and to organize a powerful and trustworthy veterinary police force, then the people (whom they should, but do not represent), have no right to complain of the inefficiency of those appointed to execute—nothing; and who are not supplied with sufficient funds to do anything if they would. That State which first makes an intelligent move in this direction, and thus demonstrates what *can* be done, will be a blessing to the whole Union. I venture to assert that the monetary loss to the cattle interests of this country from tuberculosis is greater than from all the other cattle diseases put together. From the general tone of conversation among my colleagues and breeders, I am led to think that it prevails more in Jerseys than in any other pure breeds, or among grade cattle. In Germany, Jerseys are rare, yet we shall see that tuberculosis is the chief disease afflicting cattle in that country.

What we desire to know is:

1st. To what extent does tuberculosis prevail in our cattle, and the exact proportion in each State?

2nd. Is there any evidence that climatic, telluric and geographical conditions exert the same influences upon bovine tuberculosis that they do on human?

3rd. Does any particular pure breed seem to have a natural predisposition to it; and if so, which?

4th. Does grading or out-crossing lessen this tendency?

5th. What is its proportion between pure breeds, and so-called "natives?"

6th. What evidence have we of its extension by the cohabitation of a tuberculosis animal among healthy ones in the same stable, contagium?

7th. What are the evidences which point to the predisposing influences exerted by heredity?

8th. Are these tendencies transmitted more by the bull than the cow, or vice-versa?

9th. What evidence can we gain that the milk is infectious to healthy calves, or young pigs?

10th. What are the losses that are caused by it?

11th. What amount of milk is sold from such cows in the State?

The only evidence that I can give of American origin is that of a Dr. Crundall, of Central New York. *He says: "the disease most prevalent among cattle in this district is tuberculosis; I have no hesitation in saying that fully 30 per ct. (?) of the grade cattle in the counties of Seneca and Ontario are affected with tuberculosis. In pure bred the percentage used to be higher, but on account of the losses breeders suffered from it, the herds that used to be kept here have been broken up, so I cannot tell much about that now."

In Germany there is a very exact veterinary police system under control of the governments exclusively, and a great many large towns and cities have public abattoirs, and others are building them, all being under veterinary supervision and the property of the municipalities. Up to the present time Bavaria has, however, been the only German State to attempt to gather any exact statistics with reference to the extension of tuberculosis in cattle. I have collected such, so far as was then possible, in my book on the "Relation of Animal Diseases to the Public Health." In 1877 the proportion of tuberculosis in Bavarian cattle was 1.62 per cent. to the 1,000. Of these 64 were 1 year old or under, 1.31 per cent.; 528 were 1 to 3 years old, 10.81 per cent.; 1,846 were 3 to 6 years old, 37.80 per cent.; 2,445 over 6 years old, 50.07 per cent. From 1877–1878 the percentage of tuberculosis to the 1,000 was 1 54 per cent.; from January 1 to December 31, 1874, 11,311 cattle (including calves) were slaughtered at Augsburg; of these 1.18 per cent. were tuberculous. In 1876, 13,241 cattle and 25,909 calves were slaughtered; 250 tuberculous. Of 231 oxen and 5,290 calves inspected at Munich before the building of the abattoir, tuberculosis was found in 235. Of 213 cattle condemned as unfit for food in Berlin, 1878, 49 were on account of general tuberculosis.

Augsburg, 1883: Whole number slaughtered, 11,829; tuberculosis, 3.12 per cent.

The first annual report of the Berlin abattoir was published in 1884. By this we find that the institution is in charge of a

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* Journal Comp. Med. Vol. 5, p. 330.

Chief Veterinary Inspector, assisted by ten Chief Sub-Inspectors; an Inspector's Recorder, four Branders, a supervising Microscopic expert, a Veterinarian, four Section Veterinary Inspectors, eighty-seven Sub-Section Inspectors, and thirty persons engaged in collecting specimens for microscopic examination for trichinæ. The institution has a special microscopic laboratory, well supplied with instruments and everything necessary to the work. Whole number of animals slaughtered: Cattle, 93,837; calves, 78,220; sheep, 171,077; swine, 244,343. Number of butchers slaughtering there, 567. Number of animals by which the whole carcass was condemned on account of tuberculosis, 182 cattle; hog cholera, 72 swine; icterus, 38; dropsy, 18; general bad flesh, 9; being poorly bled, 3; ecchinococci, 1; measles, 1,621 swine; trichinæ, 216 swine; calcarious deposits, 19; actinomycosis, 15 swine.

Single organs were condemned as follows: From cattle, 21,229; calves, 816; sheep, 4,806; swine, 7,401.

Tuberculosis was found in single organs of animals, the whole of which was not condemned: Cattle, 2,613 times; calves, 2 times; swine 1,313 times.

One has but to consider the lessons which such an organized and circumspect inspection teaches, and to compare it with what is done in this country, in order to see how lamentably our governments are false to their public duties.

From it we should learn: 1. That we have in reality no meat inspection in the United States. 2. That we do not really know what diseases affect our animals, or to what extent in relation to human food.

Causa Interna.—Under this heading we include all those influences, whether heredity or acquired, that produce either constitutional or organic weakness, which give to any organism a predisposition to disease, *i. e.*, that produces what we technically term a "*locus minoris resistentiæ,*" or point of least resistance. The subject is so vast, so delicate, and so important, that it is worthy of an especial essay, but at this time I can only touch upon certain points. In the consideration of the external cause of tuberculosis we have also considered, very briefly, the majority of influences that lead to an "acquired disposition," therefore we can now limit ourselves to those of an *heredity nature.*

We must bear in mind that it is not necessary that parents themselves be actually diseased in their lifetime; they may only possess a constitutional weakness; but they may transmit it to children, and if both parents possess it, the predisposing tendency is increased in the children, and they are very liable to anticipate their parents in the journey to that "bourn from which no traveler returns."

With reference to phthisis, it can be asserted that everything which tends to produce an irritable condition or weakness of the respiratory tract is to be looked upon as exerting a causal effect in producing that disease. "No bacillus, no tuberculosis," can be considered an axiom. Another is: No internal causes, no constitutional weakness, no tuberculosis, with due regard to the rational avoidance of contagium per contact. Without the pre-existence of these conditions, an infectious or contagious disease is shut off to the furthest limits of possibility. The biological study of any form of patho-bacterial life sufficiently demonstrates that if the cultivating medium, internal conditions is, not suitably composed chemically, if it has not the right degree of moisture, if the temperature offered is not conformable to their biological necessities, the bacteria cannot thrive; they die out. This is as true of the tubercle bacillus as any other. In fact they possess what we may call more constitutional delicacy, perhaps are more dainty, in these directions, than almost any form that we know of. A vigorous, healthy, respiratory tract does not offer these conditions. A weak one does, or, upon very slight irritation, may.

The existence of this last fact is the curse of our species. Through ignorance, through heedlessness, through the sensuous attractions of a pretty face, a sylph-like form; the human race is, and has been, doing its best to make true and everlasting the saying of the biblical writer, that "the sins of the father shall be visited on the children." Can the "curse" be rooted out? Yes, in time, by the combined action of the intelligence of the land. To do this one thing is necessary above all. Man must know himself. He must know that he is a subject to the material laws of his being as every other created thing. Once, the religious-philosophical discussions were full of what was and what was not "free will?"

My idea of "free will" is the ability to study the phenomena of nature, including animal life, which the mind of man has acquired in its long evolutional development. Having studied these phenomena, we have gradually acquired the ability to read the laws upon which their appearance depends. We have found that every created thing, animate or inanimate, is bound with chains of iron, scientifically speaking, by its structural, constitutional or physical direction to those laws. Even the highest representatives of animal intelligence cannot depart from them. We call this property "instinctive action." Man of to-day is the only exception. He has acquired a knowledge of these laws, even as regards himself. He can subject himself to them, or not, as he wills. This is alone his physiological superiority over the lower animals. It is all the "free will" there is. Apply the principle to humanity in relation to phthisis. In Europe the governments forbid the use of animals having constitutional weakness for breeding the higher grades. American and English breeders are gradually learning, from disastrous experience, that individual cows, or bulls, or even families do not pay to be used for breeding, on account of tuberculous tendencies. Does it pay to breed these tendencies in our children? Should not the State represent the acme of intelligence and control and forbid it by law? The influence of heredity in producing constitutional weaknesses predisposing to phthisis has long been known to the medical profession. It is time that we began to concentrate our energies and in unison with the State make an endeavor to gather well-selected statistics in this regard.

Tuberculosis having been established to be a unit, it may be well to see what observations the veterinary profession has made with regard to heredity, a few of which have already been noticed. Krunitz, 1778, wrote that: "After suffering great losses for years in consequence of the use of tuberculous animals for breeding purposes, various owners have concluded to exclude all such animals from such uses." Lyditin says: "In order to prove that the disease can extend directly from tuberculous parents to offspring we must be able to show that evidence of the same exist in the young at time of birth, or during intra-uterine life, which would lead us to infer that either the ovum or the fœtus had been affected ante-partum.

Heredity is not without influence upon the extension of phthisis. The predisposition can be given to the young by father, mother or both. Transmission of the inficiens to the ovum or fœtus, either causes sterility or abortion."

Johne has demonstrated for the first time, the presence of the specific bacilli in the lungs of a calf aborted in the eighth month of pregnancy. Adam says that, "although tuberculosis seldom develops in the fœtus, it has been sufficiently proved that, a tuberculous cow can transmit the tendency to this disease to its offspring." Busch, 1880, demonstrated the lungs of a sucking calf full of tubercles; 1878, 1 such was found at Augsburg; 1880, 5 were found at Nürnburg. Virchow, reports a case of tuberculosis of the ovaries and tubes of a sucking calf. Semmer, notices 5 cases of pulmonary tuberculosis in the fœtus of cows; they were all aborted; one at three months, another at six, another at eight; while the others were but just dropped. He says: "These cases prove to me, that tubercles can develop in the fœtus during pregnancy." Jessen found the lungs of a three months' old calf full of tubercles.

The fact already alluded to, of the intra-vital presence of tubercle bacilli in the blood, and furthermore the fact, that other forms not so minute have been shown to pass from mother to fœtus explain this dreadful phenomena. It is now left to demonstrate the bacilli in the blood of the mother and in that of the aborted fœtus at the time of the accident.

CAUSA SUFFICIENS.

Contagium.—Having endeavored to draw your attention to the causes or conditions which exert the chief influence in preparing the organism to become the seat of phthisical processes, and without which there can be no phthisis, it now remains for us to consider the essential and direct cause of tuberculosis phthisis; *i. e.* its sufficient or exciting cause.

You must not forget, however, what I have so many times placed stress upon, that, under ordinary circumstances, no predisposing conditions, no tuberculosis. Hence I say to you that, notwithstanding the immense importance of the study of mycology with reference to disease; notwithstanding the fact, that, our respective governments must be branded as traitors to their highest responsibilities, viz., the public health, for not establishing laboratories in connection with boards of health in order that researches may be made into the cause and nature of disease, still you as practical physicians, and my colleagues, as pathologists, must not be false to the terrible responsibilities which we assumed toward the public when we entered the medical profession. We must never lose sight of the value of those external and more especially the internal conditions which find their chief support in the heedlessness with which the responsibilities of parentage are assumed, entirely regardless of the welfare of its product, our babes.

Ziegler, one of the most recent authorities, says that tuberculosis is an infectious disease, which is anatomically characterized by the development of noduli. This definition is not correct in the light of the latest research. Glanders has every one of those characteristics, and one more, which is also shared by tuberculosis. The presence of bacilli in the nodulus. For us tuberculosis is a contagious disease, characterized by the development of noduli, which extend, apparently, per continui-tatem to adjoining tissues, which are of cellular character, including giant cells, having a peculiar nuclear arrangement, which finally undergo cheesy degeneration, which leads to their destruction, and finally, and above all, which owe their origin to certain bacilli, having a peculiar and specific reaction to certain specific methods of coloring never found possessed by other bacteria in the same tissues, and under the same circumstances.

The idea that tuberculosis *could be* transmitted to other persons or animals, is much older than that it is a contagious disease per se. Klenke, 1843, was the first to demonstrate that it could be transmitted to rabbits, by inoculating them with material from tuberculous cadavers. These experiments passed into forgetfulness until Villemin again repeated them, 1865, and caused the question to be one of all exciting and vital importance. It soon became shrouded in ambiguity, from the fact that an immense number of observers found that noduli not only existed in animals, but also could be produced by all manner of indifferent materials, either introduced under the skin into veins, or the great cavities of the body. Among them may be mentioned glass, setons, pus bonum, glanders material, dust, healthy and freshly slaughtered flesh, in fact almost everything that could be thought of. In rabbits especially, tubercles developed almost every time.

The experiments of Herard and Cornil, are especially interesting because, they serve to illustrate a point which I have raised against the teachings of the bacteria-school. They used substances derived from cases of caseous-broncho-pneumonia in man.

They were followed by such negative results as to lead them to deny its identity with tubercular phthisis. They again repeated them, but with material from another person. The results were positive and they changed their opinion. The fact is that, in the first case the person was not tuberculous, the bacteria had not entered into the material. The ground was ready waiting for infection. In the second case, and in all where positive results follow, this had occurred.

The material used, and the material produced must be examined, before in the first case, and post in the second in order to prove this question.

Marcet produced tuberculosis with the blood from a phthisical patient. Klebs went over the whole field and concluded that, "the noduli which develop on the inoculation of indifferent substances could not be true tubercles, since they did not possess the character of progressive infection." By this he means, extension per continuitatem, and not disseminated tuberculosis over all the organs of the body, as some have objected. Cohnheim and Frankel made very extensive experiments at the pathological laboratory, Berlin, with indifferent materials. Results positive. "The noduli produced had all the characteristics of true tubercle; hence tuberculosis is not a specific disease."

They repeated their experiments at Breslau, under far more favorable circumstances than those offered by the germ-infected laboratory at Berlin. They used the anterior ventricle of the eye of albino rabbits, and for the first time, thus supplying us with a most favorable "locus operationis." Results positive, ergo, tuberculosis is a specific infectious disease.

Haensel showed, that, tubercle followed inoculation made with syphilitic material. Buhl inaugurated another theory of infection. As he almost invariably found caseous centres which ante-dated the eruption of tubercles in phthisical patients, he concluded that, during, or by, the processes of cheesy metamorphosis, a "materia peccans" was produced, which being absorbed, acted as a specific irritant, to predisposed tissues, which resulted in the development of tubercles.

The identity of scrofulosis and tuberculosis again found advocates on this account. Spina sums up the results of this period of inoculative experiment as follows: "In view of the fact then, that not one case is reported in which healthy animals acquired tuberculosis by being confined with sickly ones (?) (he had not looked over verterinary literature), also, of the fact tubercles are, as a rule, found in close proximity to the 'locus inoculations;' and in view of the fact that, particles of the inoculated materials have been found in the tubercles produced, we are justified in concluding, that the specific character and contagiousness of tuberculosis has not been proven."

The first to really prove beyond all question of doubt, that tuberculosis did produce, or contain, an infectious principle, was a veterinarian. Gerlach's experiments were made with the milk from tuberculous cows, and not with phthisical material taken from dead persons. He says: "Having a cow afflicted with tuberculosis, it was resolved to test the question, whether the milk from such a cow is capable of producing a similar disease in young animals when fed upon it?" The results of these experiments on quite a number of young animals were partly positive, and in part negative; but they proved that the milk from such cows can produce tuberculosis in young animals when fed upon it. Bollinger (Zeimssen's hand-book, 1876), sums up the results of the milk-feeding experiments up to that time: 3 pigs, 1 positive; 2 doubtful. 3 calves, 2 positive; 1 died prematurely. 1 lamb, 1 positive. 2 dogs and 2 cats, negative. 14 rabbits, 2 positive; 6 negative. The milk given to the 6 in which negative results followed had been previously boiled.

Albert reports a case of practical observation, in which a far mers wife fed a litter of pigs on milk from a tuberculous cow that was so bad she did not dare use it. The pigs died of tuberculosis, as revealed by a microscopical examination. *Bang however, gives the most conclusive proof of the infectiousness of the milk from tuberculosis cows, and shows why such experi-

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*Journal Comp. Med. vol. 6, p. 143.

ments have occasionally failed. In every one of his cases the tuberculosis processes had extended to the udder; "mammitis tuberculosa;" and in every one of them he was able to demonstrate the presence of the specific bacilli in the milk before it was given to the calves. Results all positive. Johne has shown that it is always possible to differentiate between simple (garget) and tuberculous mammitis in the cow by the examination of the milk. I can confirm that testimony! Nocard found the specific bacilli in the milk of 11 cows with mammitis tuberculosa.

Johne reports 322 feeding experiments made with all sorts of tuberculous material; result 43.5 per. ct. positive; 51.1 per ct. negative.

These experiments were divided as follows:—

117 Animals fed with tuberculous material from calves, 61.5, posible; 34.2 negative.
46 animals fed with cooked meat from a tuberculous cow, 13.1 possible; 86.9 negative.
91 animals fed with milk, " " " 30.7 positive; 59.3 negative.
1 animal fed with milk from a tuberculous rabbit, 100.0 positive.
25 animals fed with tuberculous material from man, 30.0 positive; 64.0 negative.
33 animals fed with the tuberculous " " hogs, 53.0 positive: 47.0 negative.
2 animals fed with the tuberculous " " rabbits, 50.0 positive; 50.0 negative.
2 animals fed with the tuberculous " " monkeys, 100.0 positive.
5 animals fed from the tuberculous " " hens, 100.0 positive.

Touisaint, Chauvau and others all bear testimony that, the continuous feeding of milk from a tuberculous cow to swine will cause the disease. I have fed 3 hens with tuberculous sputum from man, they are already dead—cause tuberculosis.

Johne reports that, a flock of ten hens were daily fed with crusts of bread and leavings from a man having phthisis, the hens died of tuberculosis one after another. Zschokke relates of "a pet cat, that constantly accompanied and slept in the bed with a phthisical old maid. The cat died of tuberculosis." Ogston (British Med. Journal, 1884), reports a case which is full of warning. "In an entirely healthy family of ten persons without a discoverable trace of hereditary predisposition. One son went away from home and became phthisical. He returned home to die. The two sisters who took care of him, and a brother who slept with him, all followed him to the grave in a short time from tubercular phthisis." *Reich relates another case pregnant with warning and instruction. "From July 11th, 1875, to Sept. 29th, 1876, ten children died of tubercular meningitis, that were born between April 4th, 1875, and May 10th, 1876. These ten children were brought into the world and taken care of by a midwife, Frau Sanger, who had a habit of blowing into the mouth of all recently born babes. There was no ascertainable disposition to tuberculosis in any of the ten children. In the practice of another midwife in the same village, not one single child died or sickened of tubercular meningitis in the same time. The nurse Sanger had tubercular phthisis. In three of the children that died of tubercular meningitis, that came into my care, the disease began with bronchitis. Meningitis tuberculosa is not endemic here, only two cases having occurred from 1866 to 1874."

German veterinarians have given many cases of tuberculosis extending over the cattle of a stable from one diseased animal. Albrecht tells of a farm on which "the owner kept 14 milch cows, a bull and 4 young animals. The stables were always kept full The animals were under his observation for 3 years, during which time tuberculosis was always present. He traced it to 2 old cows that had been there the whole time. New ones introduced were healthy when bought." He gives still another case where the control was more exact. In this 19 animals died of tuberculosis in 10 years. The cause of the disease was a calf that had had a tuberculous mother. It was in the stable from 1864 to 1869, but never thrived well. In '69 it was killed and found tuberculous. In '69 other cows began to cough, and the disease gradually extended among them as was proved by necroscopi-

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* **Berliner Klin. Wochenschrift. 1878.**

cal examinations. Lydtin's works are replete with such evidence.

I will close this testimony with one more case of the kind in man. *Ollivier reports two cases of undoubted contagious infection in children, that had been previously healthy and were free from all taints of hereditary predisposition. The infection was due to living in the same room with phthisical children, and breathing the same air.

We have seen up to 1884 there were still some doubts as to the specific contagiousness of tuberculosis, and that experimental pathology had been unable to decide the question beyond all doubt. This was left to Robert Koch to do. He discovered in the sputa and tissues of tuberculous persons, and animals (cattle), bacterial organisms that were invariably present, and which had as shown, a peculiar and specific reaction to certain methods of coloring. He isolated these bacteria and cultivated them in a pure form. He was enabled to produce tuberculosis with them at will, in animals, by subcutaneous inoculation, aspiration, and by putting them in their food. He carried these cultivations through many generations, and was enabled to produce tuberculosis with them. In every case he proved the bacilli to be present in the diseased tissues of the animals experimented upon. He used this material as a means of inoculation itself; he also again made cultivations from them, and again produced tubercles in other animals. He therefore demonstrated, tuberculosis to be a specific infectio-contagious disease, due to the bacillus which bears his name.

These bacilli have been found in the urine and fœcal discharges of persons having tuberculosis of the appropriate organs, as well as the sputum. They have also been found in the catarrhal discharge of the uterus in a cow, and were afterwards demonstrated in that organ.

Koch describes the tubercle bacilli, "*as always* appearing as rods, which the name indicates; having a length of from 1–4th to 1–2 the diameter of a red blood cell. As inconstant as they are in length, even so constant are they in their transverse diameter. They are not however completely straight rods, but frequently have a notched or very slightly curved appearance, which sometimes indicates an inclination to the beginning of a spiral form. These variations from a direct line are of some value in differentiating between tubercle and other similar rod bacteria. They develop spores, which sometimes take on a streptoid form.

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*L'Union Medicale, No. 70, '85.

PROPHYLAXIS.

What should be done in order to prevent the further extension of tubercular phthisis among the people has already been sufficiently indicated, hence, all that remains for me to do is to outline to you how it must be done. In order to prevent a given disease it is necessary that we take into the most minute consideration everything that can possibly have the most remote connection with its etiology. This can only be expressed by the word *research.* To carry out this threefold purpose it is necessary that some one authority, representing the accumulated intelligence of the people on the subject of public health should be selected by the State.

Such an organization we call a state Board of Health. The work of such a board in the width and breadth of its responsibilities has scarcely dawned upon the minds of the people. Such boards are too often looked upon as honorary retreats in which to shelve useful or useless politicians. The only attribute that should make men candidates for such appointments should be fitness for the work. Such boards should be composed of an eminent jurist; the ablest hygienic special engineer attainable; a competent chemist; a specialist in public health as a medical man; and the best educated and qualified veterinarian in the State, upon matters of public health, and contagious animal diseases. The latter should be known as the State Veterinarian, and should be connected with the board of agriculture also. The men should be liberally salaried according to the time and work required of them.

The responsibililies are beyond those of any persons employed by the state.

The governor should be a member of the board, so that he be intimately acquainted with its workings; its wants and necessities, in order that he may intelligently recommend legislation. The legislature should be more liberal to it, than to other departments of government.

There is not a laboratory in the United States fitted up as it should be and liberally supplied with funds; under the control of competent experts, where researches into the cause and nature of disease are being made, or means of prevention sought for. Yet it is possible to discover a vaccine virus in a pure form that can be cultivated and dispensed in unlimited quantities, without having recourse to animals that may have the germs of tubercular phthisis coursing through their veins. It is possible to produce a practical virus against the contagious-lung-plague of cattle that has cost us millions, and will cost us many more; it is possible in this way to reduce the losses from hog-cholera to the lowest possible minimum; it is possible to find out the original source of trichnosis, and thus instruct our farmers how to feed and raise their hogs, so that the stigma may be raised from American pork, and much suffering and many lives saved in our own species. All these things are possible, and many more of a kindred nature, highly probable. But scarcely a dollar is devoted to it. Legislation should be made upon the recommendations of the Board of Health, and not according to the wills of an unreflecting and scarcely interested public, or upon the whims of legislators.

The State should be districted off into health sections, each of which should have its medical and chief veterinary sanitary official, and the necessary number of sub-officers. These men should be elected, and vacancies filled, on account of displayed competency only. The State Board of Health should be the appointing and examining body. Local boards in cities or towns should be appointed by the State Board and subject to it, and not by or to the local governments. All laws should be State, not local, so that their tenor and execution may be the same and contradictions or local inefficiency avoided. Every local, health officer should be paid for his time and services from the State funds, and the local authorities should hold the state Board of Health responsible for all neglects of this branch of the public service. The practice of medicine should be so regulated by the State that the people could if they desired, distinguish the accredited from the unaccredited man. The right of selection must be left to the people.

Malfeasance in practice should be regulated by the State, and the further right to practice in the State prohibited to the perpetrators thereof, whether a regular or irregular practitioner. All diseases should be scheduled, and all practitioners, regular, veterinary and irregular, be obliged to notify the respective local authorities of every suspicious case of disease of a contagious or infectious character, under penalty of the law. Statistics should be gathered not only with reference to the number and cause of death, but also of everything having etological connection with it. This is especially true with regard to tubercular phthisis.

We should know each year, how much occupation, manner of living, heredity and contagion have to do with the extension of this destroyer among every class of people.

Marriage inspection boards would be to day too ultra a proposition, but the medical profession should constitute itself into a marriage advisory board. If breeders of animals have intelligence enough to exclude from such purposes animals with tuberculous taints, it is about time we began to apply such principles to our own species, and thus endeavor to gradually lesson phthisical tendencies in it. The trouble does not lie in the intentions of the people, but in their ignorance. Boards of health should get the medical profession to co-operate with them, and have competent men lecture upon hygiene and the prevention of disease during the winter months all over the State. The people want knowledge and it is the duty of the state to supply them with the bread of life. It is the duty of the state to guarantee the people that, the animal products which they use as food are free, not only from disease itself, but disease producing elements, as well as their water supply.

Our milk inspection is a semi-farce. If the cows are tuberculous, or otherwise diseased; if they are improperly housed or fed, what a humbug it is to watch the stream from its fountain head to the consumer, and leave the spring itself entirely out of consideration.

The State should know the exact hygienic condition of every animal in it. By this means alone can it know how much it annually loses from this cause, and to what extent contagious or infectious diseases prevail. It cannot know what it should seek to prevent until it knows what exists, how it came to pass, and how it gets spread about.

The fact that the bacilli of tuberculosis have been found in the blood indicates that they must be in the flesh, hence, no part of such animals, or derivates from them, should be sold for human food; yet thousands of them are, and hundreds of quarts of milk from diseased cows dispensed over our cities, or ignorantly consumed by the people themselves.

We should know the exact condition of every animal slaughtered, both before and after death; we should know the condition of each individual organ, and as shown by the Berlin abattoir, an exact statistic should be kept of the results of such examinations. The state should compel the erection of municipal abattoirs in every city and large town, used for every so many thousand people in the country districts. All animals destined for human food, whether for owners use or not, should be slaughtered therein.

They should be all brick, with asphalt floors, iron doors and no wood about them. The chief inspector and technical assistants should be qualified veterinarians appointed by the state board of health, but paid by the local authorities. No animal fairs or markets should be allowed to be held unless a State veterinarian were present to supervise the health of the animals and their freedom from contagious disease. The inspection should be especially extended to the animals of visitors, showmen, pedlers or dealers.

Thus I have endeavored to sum up the preventive work of the noblest profession opened to intellect and handwork of man. Unless we one and all put all our power to the wheel, and aid in the fulfilment of this grandest of all works we are false to our responsibilities and traitors to our race.

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ART. III.—MILK: FROM A MEDICO-SANITARY STANDPOINT.*

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Anatomy of the Mammary Gland of the Cow.—The mammary gland in the cow is quadruplex, each quarter having its teat; behind these are usually found two rudimentary teats; these are rarely perforate, and more unfrequently still, give milk.† The blood supply of the gland is principally derived from branches of the external pudic artery, and is returned by the subcutaneous abdominal veins. These in milch cattle attain enormous volume and are commonly spoken of as the "milk veins;" the openings through which they enter the abdominal walls are termed the "milk fountains" or "milk doors."

The nerves are derived from the first lumbar pair, filaments from the sympathetic also reach the gland. The skin of the udder is thin, soft, devoid of pigment and sparsely covered with delicate, silky hair, always light in color. On the back part of the udder and on the inside of the posterior portion of the upper part of the thighs the hair looks upward and constitutes the "escutcheon." The size and shape of the escutcheon is held to be indicative of the milk value of the cow, and the different shapes and sizes have been tabulated and systematized by Guenon. It has been suggested that the escutcheon owes its origin to a dragging down of the roots of the

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* An essay read before the Keystone Veterinary Medical Association of Philadelphia.

† The writer recently attended a cow whose supernumerary teats occupied each side of the lips of the vagina. Mr. E. S. Dobbs, of Mt. Ephraim, N. J., had a black cow that milked from six teats.

the hair by the heavy contents of the udder, in the same way that a bag made of horsehair would have the direction of the free ends of the hair reversed if filled by a heavy substance.

Histology.—The mammary glands are conglomerate, the lobules formed by the union of the alveoli, from these the ducti lacteferi, excretory ducts, empty into the galactiferous sinuses at the base of the teats. The alveoli have during lactation a clovate form, a length of 105-180 mm. and a breadth of 60-180 mm. They are lined by cylindrical epithelium with finely granular cell contents, round or oval nucleus, with nucleolus which is sometimes double. The inter-alveolar connective tissue is fine, fibrous, containing oval and spindle-shaped cells, often united to the membrana propria by their processes. Here, also, are lymph spaces communicating with the lymph capillaries. The lacteal ducts are lined by a single layer of cylindrical epithelium, from 15-18 mm. in length and 6-12 mm. in breadth. The arteries and veins follow the course of the excretory ducts, the capillaries wind spirally around the alveoli, and form a network upon the external surface of the membrana propria.

The Secretion of Milk.—The fat of milk is the result of the activity of certain cells of the gland. It may be seen to gather in them in the same way as in adipose tissue, and is thence ejected either by rupture of the cell wall, or by an extrusive process similar to that by which the amœba rejects the undigested food. That the fat is formed by the gland and not separated from the nutritive fluids is shown by the fact that its formation is quantitatively increased by a protein, and decreased by a fatty diet. A bitch fed on meat gave off in fat through the milk a greater amount than she received with her food, gaining in flesh the while, so the supply did not come from her own reserve of adipose tissue.

The casein and lactin are likewise products of the activity of the cells of the gland. The salts are probably partly separated from the blood, in part transformed by the cells: the water is separated from the nutritive fluids. The excretion is so far under control of the will that the cow can "hold up her milk," giving considerable trouble to the milkman, and the influence of the nervous system on the secretion is considerable. Sudden fright or excitement arrests the flow, while an easy life and pleasant surroundings increase and favor it both in women and cattle The flow is promoted by regularity in the hour of milking, and by letting the cows have food before them when they are milked. (Prof. Huidekoper informs me that in the Netherlands the cattle are milked three times daily, and that the yield per diem is thus considerably increased).

Composition.—Milk is a fluid of somewhat complex composition, containing, as it does, all classes of food stuffs—protein, fatty, saccharine, and saline in an aqueous menstruum, and while its qualitative composition differs but little, the quantitative offers considerable variation in the different species of animals.

From these data we learn that the milk from an average cow contains from 12 to 13 per cent. of solids, and from 3 to 6 per cent. of fat. A remarkable feature of the analyses is the constancy of the solids not fat; whether the milk is rich or poor in cream, the solids not fat vary little from 9.25 per cent.; indeed, it has been proposed to make this the most constant factor—the standard on which prosecutions for watering shall be based. The average of nine analyses by R. O. Doremus, made for the defense in the case of the "State of New York *v.* Schrumpf" gives solids not fat 8.32 per cent. I have gone over every attainable analysis in a considerable course of reading, and can find none where the solids not fat come down so low, except in a paper on the Holstein cow, by

TABLE OF COMPOSITION IN DIFFERENT SPECIES.

Species.	Water.	Fat.	Casein.	Lactin.	Salts.	Total Solids	Authority.
Woman....	88.06	3.40	3.70	4.50	.30	11.90	Simon. (*a*)
Woman...	88.90	2.66	3.92	4.36	.13	11.07	M. Foster (*b*)
Goat......	84.49	5.68	3.51	3.69	61	13.49	Smith. (*c*)
Ewe......	83.23	5.13	6.97	3.69	.71	16.50	"
Ass........	89.00	1.85	3.56	5.05	.54	11.00	"
Mare......	90.43	2.43	3.33	3.27	.52	9.55	"
Sow	85.49	1.95	8.45	3.03	1.09	14.52	Fleming.
Bitch......	77.20	8.79	11.68	1.59	.78	22.84	"
Camel.....	86.60	3.60	4.00	5.80	not giv'n	13.40	"
Llama	86.50	3.10	3.90	5.60	.80	13.90	"
Cow.... ..	86.00	3.60	5.50	3.80	.66	13.56	Smith. (*c*)

(*a*) Frey Hist., p. 554. (*b*) Phys., p. 442. (*c*) On Foods, p. 315.

TABLE OF COMPOSITION OF COWS' MILK BY DIFFERENT OBSERVERS.

Water	Fat.	Casein	Lactin	Salts.	Total Solids	Solids not Fat.	Authority.	Reference	Remarks.
86.66	3.80	4.37	4.54	.63	13.34	9.54	Chandler.	State N.Y. v Schrumpf.	
85.96	4.00	5.01	4.30	.73	14.04	10.04	Wanklyn.	Milk Analysis.	City milk.
87.55	3.07	4.04	4.62	.72	12.45	9.38	"	"	Country milk.
87.45	3.12	4.61	4.12	.69	12.64	9.52	"	"	Alderney milk.
86.80	3.70	4.00	4.80	.70	13.20	9.50	Letheby	Parke's Hygiene.	
86.00	3.60	5.50	3.80	.66	13.56	9.96	E.Smith	Foods, p. 313	
90.15	2.91	Casein & S'g'r	6.24	.68	9.83	6.92	R.O.Doremus.	State N.Y. v Schrumpf.	Lowest 9 analyses.
81.06	9.47	Casein & S'g'r	8.37	.83	19.67	10.20	"	"	Highest 9 analyses.
86.50	5.18				14.50	8.32	"	"	Average 9 analyses.
84.55	6.44				15.45	9.01	Shippen Wallace	From herd milk.	Highest 14 analyses
87.32	3.21				12.68	9.47	"		Lowest 14 analyses.
86.27	4.28				13.73	9.37	"		Average 14 analyses.

Mr. James Neilson, of New Brunswick, published in the report of the State Board of Agriculture of New Jersey for 1882. The analyses there given were made during the Paris Exposition, on milk given by cattle there exhibited. The solids not fat are stated to be 8.15 for Ayrshire; Short Horn 8.19, and Holstein 7.80. Struck by the low percentage, I wrote to Mr. Neilson relative to the matter, and in reply he says: "The protein is undoubtedly low, as are the total solids, possibly owing to the feed and surroundings of the cattle. They were very much disturbed, owing to the tens of thousands of visitors daily."

From the constancy of the solids not fat we learn that the qualitative difference in milk from different breeds of cattle is principally in the fatty element, and I do not think that in any breed the casein is sufficiently in excess to warrant their selection for the cheese dairy on that ground: indeed, all goes to show that however much we may have increased the quantitative yield of milk by a forced survival of the fittest, extending over many generations, its qualitative composition is, save within very narrow limits, beyond our control. We cannot alter it radically any more than we can alter the composition of the blood. Could we do so, we could build up races of giants or pigmies at will.

Milk Fat.—The fat exists in milk in an emulsified state, and it is to the regular diffusion of this ingredient that the fluid owes its opacity. Its composition is:

Margarine	68	per cent.
Oleine	30	"
Fatty Flavoring Acids	2	"

Its point of fusion is, commencing 65°-68°, completing 80°-90° F.

The Casein (C. 53.83; O. 22.52; H. 7.15; N. 15.65 per 100 parts), when freed from fat and in the moist condition, is a white, friable, opaque body; readily soluble in dilute acids or alkalies, and re-precipitated on neutralization. If, however, potassium phosphate is present, as in milk, the solution must be strongly acid before any precipitate is obtained. Casein, as occurring in milk, has had several reactions ascribed to it as characteristic, but these lose their importance on considering that milk contains in addition to casein other substances, such as potassium phosphate, and a number of bodies which yield acids by fermentation. The presence of potassium phosphate has an especial influence on the reaction of casein. In the entire absence of this salt, acetic acid in the smallest quantities, as also CO2, gives a precipitate, but if this salt is present CO2 gives no precipitate, and acetic acid only when the solution is acid from the presence of free acid, and not from that of acid potassium phosphate.

Besides casein milk contains some albumin not precipitated by acids, and if milk is kept at 85° F. out of the body, the casein is increased at the expense of the albumin.

When the action of the cell is imperfect, as at the beginning and end of lactation, the albumin is in excess of the casein; but when the cells are in full functional activity the formation of casein is prominent (Foster). In addition to casein and albumin, milk, according to Millon, contains another albuminoid substance in small amount, which he calls lacto-protein.

The Milk Sugar (C12 ; H24 ; O12) has a right rotating power of 93.1° for yellow light in aqueous solution; this power diminishes slowly on standing, rapidly if boiled, until it remains constant at x 53.3° : the amount of rotation is independent of the concentration of the solution. It crystalizes in hard, colorless, four or eight-sided prisms, soluble in six parts of cold and two parts of boiling water, entirely insoluble in alcohol or ether, fully precipated from its solutions by the addition of lead acetate and ammonia. Lactose may be said to admit of no direct alcoholic fermentation. This may, however, sometimes be induced by a lengthened action of yeast. By boiling with dilute mineral acids, lactose is converted into galactose, which readily undergoes the alcoholic fermentation. This body is readily soluble in water, and has a permanent rotatory power of x 83.2°. When milk is allowed to stand the lactose passes into lactic acid, and it must be remarked that while isolated lactose is incapable of direct alcoholic fermentation, milk itself may be fermented. Berthelot was unable in this direct alcoholic fermentation to detect any intermediate change of the lactose into another fermentable sugar (Foster).

Milk Salts.—

PERCENTAGE OF SALTS. (*a*).

Calcium Phosphate	0.3
Magnesium "	.06
Ferrum "	.007
Potassium Chloride	.17
Sodium "	.03
Soda, free	.04
	.607

———o———

IN 100 PARTS OF MILK SALTS THERE ARE (*b*)

Potash	23.46
Soda	6.96
Lime	17.34
Magnesia	2.20
Chloride Potass	14.18
" Sodium	4.74
Phosphoric Acid	28.40

(*a*) Smith, on Foods, p. 316 ; (*b*) op. cit., p. 317.

Colostrum.—The first milk secreted after delivery—the "colostrum," *anglice*, beaslings or beastings—differs considerably in composition from normal milk. Its specific gravity is increased, being in cows' milk 10.63; the free fat globules are smaller than normal, and are present in diminished quantity. There are also present numerous "colostrum corpuscles," larger than normal fat cells, of spherical or ovoid shape; they are usually found in agglomerated masses. Colostrum also contains active leucocytes. Fleming states that the colostrum corpuscles are epithelial cells, with fatty contents, and also states that albumin largely takes the place of casein in this, the first secretion of the gland. Toward the end of lactation, if the animal is pregnant, albumin again takes the place of casein, the milk coagulates with heat, and the sugar decreases in amount or disappears altogether. The colostrum has purgative properties, being apparently a device of nature for ridding the intestines of their contents accumulated during intra-uterine existence—the meconium. At or about the fifth or sixth day of lactation the colostrum is replaced by ordinary milk.

COMPOSITION OF COLUSTRUM.

SPECIES.	Water	Fat.	Albumin	Lactin.	Mucus.	Authority.
Cow........	75.80	2.60	15.00	3.60	Salts, 3.00	Boussingault.
Cow........	80.33	2.60	15.07	Traces.	2.00	Dumas.
Ass	82·84	5.60	11.60	4.30	.70	"
Goat.......	64.10	5.20	24.50	3.20	3.00	"

COMPOSITION OF BUTTER-MILK AND SKIM MILK.

	Water	Fat.	Casein.	Lactin.	Salts.	Authority.
Buttermilk..	88.00	.70	4.10	3.60	.80	Smith.
Skim milk..	88.00	1.80	4.00	3.80	.80	"

From the table of composition it will be seen that buttermilk approaches in composition to skim milk. It is a valuable article of diet, in health, especially for the poor, whose dietary is apt to be deficient in nitrogen. In many parts of the British Islands it constitutes an important article of food, and its use in India is universal. As a food it is regarded as so important by the pastoral tribes of Meerut that they say "a man may live without bread; without buttermilk he dies." There are about 336 grs. of carbon, and 35 grs. of nitrogen in a pint of buttermilk.*

The Inspection of Milk.—Owing to the fact that milk mixes in all proportions with water, the pump has been from time immemorial the milkman's best friend. Water is added in all proportions, from the lump of ice placed in the can without dishonest intentions, to the 60 per cent. of water and 40 per cent. of milk peddled by a dealer in New Jersey who, when caught, was selling 34 quarts off a yield of 14. How can this fraud be detected? In a limited degree it cannot be detected at all—we must grin and bear it.

With a view to limit this fraud, examinations have been made of a great many samples of milk, in order to determine its minimum specific gravity, and in mixed milk from healthy cattle this has not been found below 10.29 at 60° F.

Here the experimenters had something to work on, a hydrometer adapted to the fluid would do the work, hence the lactometer; this instrument, valuable though it is, cannot be said to have fulfilled the high hopes entertained for it. If a hydrometric reading of alcohol is taken at a temperature of 70° F., a reference to Piles' tables shows at once what the result represents at 60° F. This cannot be done with milk. It is not a fluid of definite chemical composition, and the expansibility of its components varies with alterations of temperature.

Thus a sample of milk tested by Prof. Chandler, which stood at 100° of the lactometer at 60° F., was found to stand at 106° at 44° F.; at 98° at 66° F.; at 90°, at 80° F., and at 74°, at 100° F.† Again, the fatty portion of milk is the lightest;

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* Smith, on "Foods," p. 329.

† Mott, on "Milk," p. 23.

consequently the more fat the less the specific gravity, so, were we blindly reliant on the lactometer we might condemn as watered a milk rich in fat and all solids. Conversely, the removal of the cream increases the specific gravity, and a careless official might compliment a high-standing sample, while the milkman laughed in his sleeve, and drove round the corner to sell the cream he had removed. We have talked about the lactometer. What is it? It is a very delicate hydrometer, its scale running from 1000, marked 0 on the scale, to 1034, marked 120; that is to say, it has a range from a specific gravity of water to that of an extremely rich sample of whole milk, or thoroughly skimmed milk. I am speaking of the New York Board of Health instrument. The French demand a specific gravity of 1030. Many of the instruments of the shops are graduated carelessly, and are therefore worthless, and an inspector's instrument should be compared with a standard one before being used. It is curious to note how sanitary authorities differ in regard to the value of this instrument. The New York Board of Health prosecutes and gets convictions on its readings. Wanklyn, the English analyst, says it is utterly unreliable. In the State of New Jersey, a middle course is taken—the lactometer is used in examinations, but prosecutions are based on the percentage of solids as shown by chemical analysis. The instrument must be used along with a level head. The idea that milk so rich in cream as to send the lactometer below a hundred would be condemned is on the face of it absurd. In the first place, very few dealers handle milk of this description without letting it down prior to offering it for sale. In the second, a sample of this character would at once attract attention to its physical properties, appearance, taste, method of leaving the lactometer (milk rich in cream clings to the instrument, leaving it slowly; watered, and especially skimmed milk leaves it at once on withdrawal). On the other hand, if a sample goes above 110 without being manifestly full-bodied, it is fair to presume that a portion of the cream has been removed. The real difficulty with the lactometer is this: to allow for the production of milk poor in solids the standard is placed far too low for the bulk of the milk raised; thus, taking a sample of pure milk—S.G., 1.0314; lact., 108, we get the annexed result by watering the whole milk and the same sample skimmed.

	UNSKIMMED.		SKIMMED.	
	S. G.	Lact.	S. G.	Lact.[*]
Pure Milk	1.0314	108	1.0337	117
10 per cent. Water	1.0295	102	1.0308	106
20 " "	1.0257	88	1.0265	91
30 " "	1.0233	80	1.0248	86
40 " "	1.0190	66	1.0208	72
50 " "	1.0163	56	1.0175	60

It will be seen that 10 per cent. of water can be added before the 100 mark is reached, and to richer milk still more water could be added. The inspector will often be asked by dealers or producers why the standard is fixed at a certain percentage of solids, and he cannot answer the question better than to quote the words of Dr. W. K. Newton, State Inspector of New Jersey. "A word here as to the claim that the standard is an average. In answer to this I shall say that the standard is not *an average*, but a limit, and was not arrived at by averaging, but was adopted when it was conclusively shown that the milk produced in this State *never went below* 12 per cent. solids. Persons who object to the standard would usually resist the legalizing of any limit, and the objection is not so much against the limit fixed by law, as it is against any limit whatever.[†]

Good milk is creamy white or yellowish in tint, is thoroughly opaque, shows no blue line around the edge of the containing vessel, has a full, satisfying, somewhat unctuous taste, and (except its characteristic animal smell) is odorless; it is feebly acid or neutral in reaction. (Fleming says it is acid in carnivora, alkaline in herbivora).

To examine milk with the lactometer the sample must be thoroughly stirred, to insure the admixture of the partially separated cream, a quantity removed into the hydrometer jar or tin, and the lactometer allowed to sink gently into it, taking care not to wet the stem above the 100 mark during its insertion, as the small amount of adherent fluid would make some difference in the reading.

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[*] Mott, on "Milk," p. 25.

[†] Dr. W. K. Newton, 7th Rep. N. J. S. B. H., 1883, p. 255.

The vessel should be full, in order to allow the reading to be correctly taken. After taking these precautions, should the sample go below 100 at 60° F. or below 60° a "serving kettle" should be procured, and a quantity of the milk poured repeatedly from one vessel to the other. It should then be tested again. This should always be done, in justice to the dealer, and I have seen it make a difference of several degrees. After this, if the lactometer still stands below 100 at a temperature of 60° F., or below 60°, a sample must be taken in a perfectly clean, dry bottle (four ounces is a sufficient quantity, and a number of clean dry corked four-ounce bottles should be carried in the inspector's valise for this purpose). The bottle must be sealed in the presence of a witness and should bear a label on which the name of the shipper, the dealer's name, their residences, the date, and the inspector's name should be plainly written. What is to be done with the condemned milk? In the earlier operations of the milk law in New Jersey it was thrown into the gutter, and the power still remains with the inspector to follow this course if he thinks proper. I have never done this. The mind of the public is apt to be shocked at the apparently useless waste of valuable property, and the same end can be attained by shipping the condemned milk back to the producer, "freight forward." It is only fit for the swill-barrel when it reaches its destination. In winter, when milk is frozen, or nearly frozen, in the cans, it is not practicable to use the lactometer, and at this season the inspector should confine himself to taking samples, two cents' worth of milk being purchased from each dealer, placed in a bottle, sealed, and submitted to the analyst. If he finds the specific gravity and general appearance of the sample all right, there is then no need to analyze it.

Particular attention should be paid by the inspector to places where milk is sold by the glass—confectionery stores, restaurants, milk depots. In the State of New Jersey skimmed milk is not allowed to be offered for sale in cities of the first-class (Newark and Jersey City), the State Inspector finding it impossible to stop its substitution for whole milk by other means, though it is probable that the infliction of a heavy penalty (say $200, with imprisonment at the discretion of the court) would stop it. A small fine is useless. The dealer can pay it occasionally, and still make money out of the fraud.

Whatever the standard assumed, it must be rendered arbitrary, prosecution must as quickly follow a falling below the standard of a quarter of one per cent. as for a shamefully watered sample. The State Inspector of New Jersey has set all sanitary officers an example in this regard. A milkman pulled up for a sample containing total solids, 11.80 or 11.90, will meet with no better treatment than he would had he reduced the solids one-half. This is as it should be, and is the only way to enforce laws bearing on sanitary medicine; the "give an inch and take an ell" applies nowhere better than here. In works on sanitary medicine and food adulteration, a number of sophistications, besides watering and skimming, are mentioned; those mentioned in the English works are rarely used here, and those most frequently used in this country (milk preservatives) find no mention in any works I have consulted. Bicarbonate of soda is added to correct acidity; annatto, turmeric and yolk of egg, to give color and apparent richness; solutions of gelatine or isinglass, to give body; chalk, to increase the specific gravity and correct acidity. Sheep's brains are stated to have been found in milk. The preservatives in common use are boracic acid, borax, salicylic acid in small quantities, and the patented preservatives, "Rex Magnus" and "Humiston."

It is sometimes convenient to make a rough determination of the cream without resorting to analysis. This may be done in two ways:

First.—By taking a long test-tube, and pasting on it a slip of paper, divided into 100 equal parts by the compass; fill it with the milk, place it in a closet free from currents of air, let it remain twenty-four hours, and note the number of divisions on the slip which are occupied by the cream (Wanklyn states that 1 gramme cream = 0.2 gr. of fat). There is, however, considerable difference in the readiness with which different samples of milk "throw up their cream," and this, in a degree, renders this test valueless. Thus, it is asserted that a "butter cow," having the fat globules of her milk of larger size than a "cheese cow," throws up her cream more readily and completely, thus getting a reputation through the "creamometer" not sustained by analysis.

The *second* method is to examine with the "lactoscope." This

LACTOSCOPE TABLE.

CC. Milk	To 100 parts of water obscures the light=	Per cent. Fat.
1.	“ “ “ “ “	23.43
1.5	“ “ “ “ “	15.69
2.0	“ “ “ “ “	11.83
2.5	“ “ “ “ “	9.51
3.0	“ “ “ “ “	7.96
3.5	“ “ “ “ “	6.86
4.0	“ “ “ “ “	6.03
4.5	“ “ “ “ “	5.38
5.0	“ “ “ “ “	4.87
5.5	“ “ “ “ “	4.45
6.0	“ “ “ “ “	4.09
6.5	“ “ “ “ “	3.80
7.0	“ “ “ “ “	3.54
7.5	“ “ “ “ “	3.32
8.0	“ “ “ “ “	3.13
8.5	“ “ “ “ “	2.96
9.0	“ “ “ “ “	2.80
9.5	“ “ “ “ “	2.67
10.0	“ “ “ “ “	2.55
11.	“ “ “ “ “	2.43
12.	“ “ “ “ “	2.16
13.	“ “ “ “ “	2.01
14.	“ “ “ “ “	1.88
15.	“ “ “ “ “	1.78
16.	“ “ “ “ “	1.68
17.	“ “ “ “ “	1.60
18.	“ “ “ “ “	1.52
19.	“ “ “ “ “	1.45
20.	“ “ “ “ “	1.39
22.	“ “ “ “ “	1.28
24.	“ “ “ “ “	1.19
26.	“ “ “ “ “	1.12
28.	“ “ “ “ “	1.06
30.	“ “ “ “ “	1.00
35.	“ “ “ “ “	.89
40.	“ “ “ “ “	.81
45.	“ “ “ “ “	.74
50.	“ “ “ “ “	.69
55.	“ “ “ “ “	.64
60.	“ “ “ “ “	.61
70.	“ “ “ “ “	.56
80.	“ “ “ “ “	.52
90.	“ “ “ “ “	.49
100.	“ “ “ “ “	.46

instrument consists of a little cup, formed by two parallel pieces of glass, distant half a centimetre from each other, and closed everywhere except at the top. The auxiliary apparatus consists of a glass, graduated to 100 C C., and a pipette having a capacity of 5 C C. 100 C C. of water are placed in the measure, and 2-3 C C. of the milk to be tested are added; the "lactoscope" is then filled with this diluted milk, and a candle placed one metre distant from the apparatus is looked at through it. Should the contour of the flame be seen, the milk is poured back into the large measure and more undiluted milk added, this being repeated until the mixture obscures the contour of the flame; the percentage of fat is then calculated by the following formula, determined by a comparison of the results given by the lactoscope and by chemical analysis:

Let x = percentage of fat, and m the number of CC. of milk required.

Then $x = \frac{23.2}{m} + 0.23.$

Thus, if 3 CC of milk were required to obscure the light, the equation would stand

$$x = \frac{23.2}{3}\ 0.23 = 3x = 23.2 + 0.69 =$$

$$3x = 23.89 = x = 7.96 = \text{p. c. of fat in milk.}$$

To save the trouble of calculation, the preceding table has been made.

It now remains to examine the results obtained by this instrument. The following were obtained by Dr. Heeren:*

No.	Chemical Analysis.		Lactoscope.		No.
1	Fat................	3.160	Fat	3.140	1
2	"	5.018	"	5.610	2
3 (*)	"	4.225	"	5.000	3
4 (†)	"	2.312	"	1.660	4

Now skimmed milk contains smaller fat globules than intact milk, and these cause a greater cloudiness in proportion to the existing quantity of fat than larger ones, and as the optical test is based on the degree of opacity, its results are not equable for skimmed and whole milk or watered milk. In watered or whole milk the lactoscope demonstrates the fat with considerable exactness; in skimmed milk it favors the dealer. Its great value is to the producer, as he is thereby furnished with a ready means of ascertaining the percentage of fat at little trouble or expense. Indeed, by the aid of the lactoscope we may make a quasi-analysis of milk without any very delicate apparatus, by thoroughly drying 100 C C. until it ceases to lose weight we get the total solids. A lactoscopic examination gives the fat, and this subtracted from the total solids gives the solids not fat.

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* Mott, on "Milk," p. 49, *et seq.*

† Nos. 3 and 4 somewhat skimmed.

TABLE SHOWING VALUE OF THE DEGREES OF THE NEW YORK BOARD OF HEALTH LACTOMETER IN SPECIFIC GRAVITY.

(From Mott, on "Milk.")

Lact.	S. G.	Lact.	S. G.	Lact.	S. G.	Lact.	S. G.
0	1.00000	31	1.00889	61	1.01769	91	1 02639
1	1.00029	32	1.00928	62	1.01798	92	1.02668
2	1.00058	33	1.00957	63	1.01837	93	1.02697
3	1.00087	34	1.00986	64	1.01856	94	1.02726
4	1.00116	35	1.01015	65	1.01885	95	1.02755
5	1.00145	36	1.01044	66	1.01914	96	1.02784
6	1.00174	37	1.01073	67	1.01943	97	1.02813
7	1.00203	38	1.01102	68	1.01972	98	1.02842
8	1.00232	39	1.01131	69	1.02001	99	1.02871
9	1.00261	40	1.01160	70	1.02030	100	1.02900
10	1.00290	41	1.01189	71	1.02059	101	1.02929
11	1.00319	42	1.01218	72	1.02088	102	1.02958
12	1.00348	43	1.01247	73	1.02117	103	1.02987
13	1.00377	44	1.01276	74	1.02146	104	1.03016
14	1.00406	45	1.01305	75	1.02175	105	1.03045
15	1.00435	46	1.01334	76	1.02204	106	1.03074
16	1.00464	47	1.01363	77	1.02233	107	1.03103
17	1.00493	48	1.01392	78	1.02262	108	1.03132
18	1.00522	49	1.01421	79	1.02291	109	1.03161
19	1.00551	50	1.01450	80	1.02320	110	1.03190
20	1.00580	51	1.01479	81	2.02349	111	1.03219
21	1.00609	52	1.01508	82	1.02378	112	1.03248
22	1.00638	53	1.01537	83	1.02407	113	1.03277
23	1.00667	54	1.01566	84	1.02436	114	1.03306
24	1.00696	55	1.01595	85	1.02465	115	1.03335
25	1.00725	56	1.01624	86	1.02494	116	1.03364
26	1.00754	57	1.01653	87	1.02523	117	1.03393
27	1.00783	58	1.01682	88	1.02552	118	1.03422
28	1.00812	59	1.01711	89	1.02581	119	1.03451
29	1 00841	60	1.01740	90	1.02610	120	1.03480
30	1.00870						

MILK ANALYSIS.

Total Solids.—Evaporate 5 CC. on a water bath in a weighed platina dish until it ceases to lose weight. The evaporation must be continued for at least three hours. Multiply the result by 20 to get percentage. We thus at one stroke determine two factors—water and total solids.

Fat.—Treat the total solids with ether until they again cease to lose weight, weigh, note the loss and calculate percentage. Wanklyn directs that the fat be recovered from the ether and weighed, but as the ether extracts the fat only, the loss is represented by the fat, and the ether can be preserved for redistillation. Care should be taken that the ether is dry, or some sugar will be removed.

Casein.—Treat 10 C C. with acetic acid and boil, adding a considerable amount of water; let it stand twenty-four hours, pour off the supernatant fluid, dry the precipitate, treat with boiling ether to remove any adherent fat, dry again until the weight is constant, weigh and calculate percentage.

If a more accurate determination of casein is required the casein may be broken up into ammonia by permanganate of potash in the presence of an alkali and the albuminoid ammonia determined by Nessler's test. Each part by weight of casein gives by this process, 0.065 parts of ammonia, and the yield of albuminoid ammonia from 100 C C. of good milk is about 0.26 grammes. Full details for working the process will be found in works on water analysis.

Lactin.—Take a measured quantity of whey, evaporate to a constant weight on a water bath, and subject it to gentle ignition the residue subtracted from the total weight before ignition represents the lactin. Calculate percentage.

2d *Process.*—Take 10 C C. of milk, add a few drops of acetic acid, warm and filter; make up to 100 C C. with water, and put the filtered whey (which should be as clear as possible) into a burette. Place in a porcelain dish 10 C C. of Fehling's solution and add to it 20-30 C C. of water; boil. As soon as it boils briskly drop in the whey from the burette, taking care that the copper solution is left boiling. Continue the process until all the copper is reduced to sub-oxide and no blue color remains in the supernatant liquid, but stop before any yellow color appears. Read off the amount of whey used and divide by 10. The result is the amount of milk which exactly decomposes 10 C C. of the copper solution; this equals .0667 gr. of lactin; the amount of lactin in 10 C C. of milk is then found by proportion and the percentage determined by shifting the decimal point one figure to the right. Example, 15 C C. of diluted whey were required to reduce 10 C C. Fehling's solution representing 1.5 grammes original milk. Then

$.0667 \div 1.5 = 0.0445$ gr. lactin in 1 C C. of milk.
Therefore, $0.0445 \times 100 = 4.45 =$ per cent. of lactin.

Ash.—Incinerate dried solids, weigh, and calculate percentage. A very high per cent. of ash should be looked on with suspicion, as pointing to the addition of preservatives.

ADULTERATIONS.

Starch and Dextrin.—The iodine test reveals the presence of starch, and with the addition of a drop or two of acetic acid and boiling, the presence of dextrin.

Turmeric.—A concentrated solution of the milk turns a deep brown when treated with alkalies: the cells may be detected by the microscope if the powder has been used.

Annatto.—The concentrated milk is orange red, and the color can be extracted by alcohol; it is turned purplish by acids and brighter red by alkalies.

Soda Bicarb.—The ash effervesces with acids, prove presence of base by blow-pipe test.

Chalk gives sediment and ash effervescent with acids.

MILK AS A FOOD.

At what remote period the milk of animals was first used as a food by man we do not know, though its use is probably coincident with the time when men took the first step in civilization by the adoption of a pastoral life.

"The peasantry of Sweden and Norway, of Switzerland and the Tyrol, the Bedouins of Arabia, the people of Kurdistan and other mountainous countries in the East live in great part on milk." "Camels' milk is in common use among the Arabs and is often mixed with flour into a paste and boiled, when it is called Ayesh."

"It is also eaten largely by those living on the Thull, a sandy and unproductive district at Lera, in India, and it is stated to have a brackish flavor and little fat."* In the Old Testament allusions to milk are frequent. though apparently the milk of goats and camels was more used than that of the cow. So long as the tribes continued in a pastoral condition this may be accounted for by the greater readiness with which these animals moved from place to place, the milk supply being subordinate to their value as beasts of burden, or the value of their flesh as food. "And he took butter and milk and the calf which he had dressed, and set it before them." (Genesis xviii. 8.) Jacob gave Esau thirty milch camels and their colts. (Genesis xxxii. 15) "And thou shalt have goats' milk enough for thy food, for the food of thy household, and for the maintenance of thy handmaidens." (Proverbs xxvii. 27.) "Surely the churming of milk bringeth forth butter." (Prov. xxx. 33.) The milk of the buffalo is used in Egypt and is said by travellers to be of very rank and disagreeable flavor. During the first months of life milk constitutes the sole food of the mammalia, the young animal being a parasite of the mother. As shown by the table of composition it differs in composition in the different species of animals—the milk of the carnivora being the richest and that of the soliped herbivora the poorest in solids: indeed the milk of the bitch is so rich that great difficulty is experienced in bringing up puppies by hand, and in some parts of France where wet nurses suckle puppies in order to prolong lactation, the animals usually become rachitic. Milk also differs in composition at different periods of lactation. †

In the human species the amylolytic properties of the salivary and pancreatic glands are not developed until about the eighth month of life; and starchy food should therefore be

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* Smith on Foods, p. 318.

† Ewes' Milk, 3 weeks after lambing.

Water,	75.00
Fat,	12.78
Casein,	6.58
Lactin,	4.66
Ash,	.98
	100.00

Ewes' Milk, 6 weeks after lambing.

Water,	86.70
Fat,	3.67
Casein,	4.44
Lactin,	4.00
Ash,	1.19
	100.00

Fleming, Obstetrics, p. 255

withheld until this period is past. In the lower animals the development of the deciduous teeth and the instinctive weaning process adopted by the mother mark the time when the ability to grind, and digest food of its own seeking is attained by the young animal. In woman, and in the lower animals when in the wild state, the secretion of milk ceases when the young are weaned, but in the cow (and in some countries, the mare, ass, reindeer, sheep, camel and goat) the secretion is made permanent by the influence of domestication and selection—the cow often milking up to the time of the next parturition, and if the animal is spayed when in full milk the secretion may be continued for several years, the fat and casein being increased.*

When the mother cannot nurse her infant, or when there is reason that she should not do so, it is usual in this country to substitute the milk of the cow. (On the continent of Europe and in Great Britain the milk of the ass or goat is often used, and in 1819 Dr. Twierlien, a German, wrote a book recommending goats as wet nurses.) Asses' milk when attainable is probably the best, assimilating more closely in composition to mothers' milk than does that of the cow. During the first few months of life the milk should be diluted with an equal bulk of water, the amount of milk being gradually increased as the stomach grows better able to digest it, so that when the infant reaches about the ninth month, the amount of added water should be about one third; and when the first year is attained the milk may be given undiluted. The milk of one cow is usually preferred, though if the digestive organs are strong the infant will do equally well on herd milk.

Care should be taken that the source of supply is healthy well nourished, and amid good hygienic surroundings; should the milk disagree these points should at once be looked into. It often happens that while the milk agrees well with the child while the cow is "fresh," as time goes on, and the animal becomes again advanced in pregnancy, the increment of weight of the child is insufficient and dentition is tardy or arrested: under these circumstances a change of supply is imperative. If this cannot be done extra cream and limewater may be added to the milk.

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* C. Schmidt, Amer. Vet. Rev., vol. 1, p. 316.

The cow should be milked at regular hours, as the retention of the milk in the gland for an hour or two after the regular time of milking will cause it to sour several hours sooner. Slop fed milk must be avoided, though if grains are fed moderately in conjunction with other food, the nutritive qualities of the milk do not seem to be impaired. Cattle pastured in meadows where access is had to aquatic plants are not a proper source of supply, the common spatter dock appears to be especially obnoxious in this regard. Milk sugar is better than cane sugar to give sweetness to the child's milk. The milk should be given at a temperature of 95° F. When the period of infancy has passed milk should still constitute a large portion of the child's food, indeed through the whole period of life milk must be regarded as a very important article of diet; and the suggestion that the aged may by its use smooth the way to the Euthanasia dates from the days of Galen.

The Therapeutic Uses of Milk—.Milk is given in disease because it presents in an easily assimilated form a considerable amount of nutrition, taxing the digestive apparatus but little, and offering no mechanical irritation to the alimentary tract. It is also used as a direct therapeutic agent. In acute diseases anorexia usually accompanies the fever, and when their course is prolonged the excessive oxidation of tissue leads to a degree of debility often overshadowing in importance the cause thereof: Thus in enteric fever it is not uncommon to see the fever break and leave the patient too exhausted to rally: the patient has worn out the disease, to be in turn worn out by the attendant debility, and the feeble spark goes out. So long as he can take and assimilate food one great source of anxiety is removed for the practitioner, and milk to-day constitutes the regimen of most of these cases, given with limewater or with alcoholic stimulants.

Should the stools contain undigested casein, recourse may be had to artificial digestion of the milk, and it may be proper in this connection to consider this question of artificial digestion. When milk reaches the stomach the casein is precipitated by the acid gastric juice, and the change from insoluble albuminoid to soluble peptone commences, then as the process continues it becomes, so to speak, retarded by its own activity;

the envelopes of the fat cells are dissolved and the fat mixing intimately with the material undergoing digestion so sheathes the casein as to protect it measurably from the action of the gastric juice, and it is principally in the small intestine that milk is digested: the digestion is pancreatic and alkaline, not peptic and acid in character.

Now if in fever the stomach and pancreas have struck work, the chance for the digestion of milk are small indeed, and " an acute attack of intercurrent indigestion is often a veritable thundercloud in a clear sky to the practitioner; he must drop everything else and devote himself to tranquilizing the iritable organs of digestion.*

The digestion of the food by means of the pancreatic secretion as now offered by several chemists often enables him to do this and save life. When 5 grs. ext. pancreatic (Fairchilds) and 15 grs. of bicarbonate of soda are dissolved in a gill of water and added to a pint of milk, placed in a bottle and this immersed in a pitcher of hot water covered so the milk will retain its acquired heat, and allowed to stand for an hour and a half in a warm place artificial digestion of the milk takes place, the kypsin converts the albuminoids into peptones, the pancreatin emulsifies the fat, mechanically fitting it for absorption by the intestinal villi; the contents of the bottle become grayish-yellow in color, acquire a bitter taste, and the milk becomes perceptibly thinner: the result is milk ready for absorption. As great heat or cold stops the process, all that is necessary when the required degree of digestion is reached (to be determined by the condition of the patient's digestive organs), is to place the milk on ice or in boiling water; it may then be kept like ordinary milk. The added alkali serves a double purpose, it hastens the process and guards the product through the stomach. So active is this agent that if you add it to a bowl of bread and milk the milk will become thinner and the bread much softened during its leisurely consumption.

As a therapeutic hint it may not be out of place to remark that pancreatin, not pepsin, is the proper addition to nutritive enemata, the secretion of the rectum is alkaline not acid. Milk is a food of especial value where mechanical conditions (carcinoma of the stomach, gastric ulcer, irritation from poisons, stenosis of the pylorus, &c.), offer an obstacle to digestion by the pain they excite, or their interference with the passage of food along the canal. "When it becomes necessary to confine a patient for some time to a diet consisting exclusively of milk, great difficulty is often experienced in overcoming the repugnance of the patient. Although as a rule it is taken readily at first, after a time it begins to pall on the appetite and the greatest resolution is necessary on the part of the patient in order to continue it. A distressing sense of emptiness is experienced in the epigastrium. The mouth becomes pasty, and the tongue is coated with a thick whitish fur. Constipation, sometimes exceedingly obstinate, occurs, and the stools are hard and of an ochre yellow color. Occasionally diarrhæa is produced, but this is due to the fact that the milk disagrees and is not digested. The urinary secretion is increased in amount, but this is due simply to an increased flow of water. Although milk contains all the constituents necessary for the nutrition of the body, when it is used as an exclusive article of diet in the case of those accustomed to a full mixed diet, a decided diminution in the weight of the body takes place. After a time, however, the waste ceases, and the weight continues at a uniform level. The interference of a milk diet with nutrition is more decided when skimmed milk is used — a form in which it is usually administered in intestinal disorders. The pulse is quickened and the arterial tension lowered, but a fall in the pulse rate occurs when the body ceases to lose weight. A marked degree of debility is experienced by some persons, so that they are unable to take exercise. In two cases in which I used this treatment with signal success— chronic eczema, and chronic ulcer of the stomach—the patients, both females, experienced vertigo and faintness; and Mitchell mentions a case in which from the same cause he was obliged to discontinue the milk. Ordinarily, however, nothing more than weakness is experienced." BARTHOLOW.

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* Dr. Milner Fothergill. Indigestion and Biliousness.

With regard to the dose, Bartholow recommends the administration of 4 oz. every 3 hours at the commencement of the treatment, increasing the amount as the patient becomes able to bear it until he takes all he can assimilate.

Mitchell's limit is determined by the patient ceasing to lose weight. He uses milk only, for three weeks, making gradual additions to the diet, until about the sixth week the patient returns to a mixed diet, which for some months consists largely of milk. Dyspepsia, gastric catarrh, gastralgia, chronic diarrhœa, dysentery, ascites, anasarca, albuminuria, diabetes, eczema, gout, and gouty affections, have been removed by a persistence in this plan of diet. Owing to its diuretic properties milk is especially indicated in scarlet fever, reducing the danger arising from the attendant albuminuria.

Buttermilk is a useful remedy for the nausea of chronic alcoholism, and is a well known domestic application for tan or sunburn.

Formula for diet, drinks, &c., consisting principally of milk:

WINE WHEY.

Take 2 pints new milk, 4 oz. sherry wine. Heat the milk over a clear fire until nearly boiling, then add the sherry, simmer a quarter of an hour, skimming off the curd as it arises, then add a tablespoonful more sherry, and skim for a few minutes.—DR. BARTHOLOW.

ARROWROOT WITH MILK

Put into a saucepan to boil one pint of milk; stir very smoothly into a cup of cold milk a dessert spoonful of arrowroot. When the milk boils stir in the arrowroot, continuing to stir until it is cooked (5–10 minutes); then remove from the fire and sweeten to the taste.—PARRISH.

EGG NOGG.

Scald a tumblerful of new milk, not allowing it to boil; when cold add to it an egg, beaten to a froth, with sugar and a dessert spoonful of brandy.—DR. BARTHOLOW.

TAPIOCA WITH MILK.

Tapioca two tablespoonfuls, water two teacupfuls, soak over night, add a little salt and a pint of milk, simmer until quite soft, stir well and while cooling pour into a bowl, sweeten to taste and add wine and nutmeg if desired.—PARRISH.

CASTILLON'S POWDERS.

Powdered Tragacanth,
" Sago.
" Salep.
" Sugar, of each 1 oz.

Prepared oyster shells 2 drachms. Mix. Divide in powders weighing 1 drachm. Mix a powder with four tablespoonfuls of cold milk in a bowl, transfer to a milk pan, add gradually while stirring a pint of boiling milk, boil for 15 minutes and sweeten to taste.—PARRISH.

PEPTONIZED MILK GRUEL.

Take of good thick gruel and cold milk each half a pint (Imperial), add the milk to the gruel while the latter is still boiling (the mixture will have a temperature of about 125° F.) To this mixture add 15 grs. ext. pancreatis (Fairchilds) and one scruple bicarbonate of soda, keep warm in a covered jug for two hours, boil and strain.—Adopted from DR. ROBERTS.

KOUMISS.

Milk may, by undergoing alcoholic fermentation, pass into a sort of milk wine, and following out the inborn desire of mankind for alcoholic stimulants, the nomad races of the Steppes convert the milk of the mare into "koumiss." Not alone, however, as a beverage is this used. It is stated, and that by some very competent authorities, to be a remedy of great value in phthisis and other wasting diseases. It is retained and assimilated when other food is rejected, and the increase of weight in some cases under its use borders on the marvellous. (Jagrelsky says that he has had patients gain as much as ten pounds a month, when no other food was taken). "Koumiss is prepared from milk by the addition of a ferment —some koumiss obtained from a previous fermentation, or dried koumiss—it is allowed to ferment three days at a temperature of from 70° to 80° F. It is then a bluish-white liquid, having a sharp, acidulous taste, and none of the characteristics of ordinary milk. If heated to 100° F. fermentation is definitely arrested. Allowed to stand after three days' fermentation it separates into three layers—the inferior caseous, the middle (an acid water), and the uppermost (a whitish fluid), the best koumiss." "The quantity of koumiss administered depends on the condition of the patient. In cases of feeble digestion (this being the only article of food) an ounce every hour will be a sufficient quantity. With increased facility in its digestion and assimilation, from a quart to a gallon per day may be taken. When it is used in connection with other food a tumblerful may be administered after each meal. It is estimated that each quart of koumiss contains four ounces of solid food. The tolerance to koumiss is remarkable, even in cases of gastralgia. It improves the appetite and excites the action of the kidneys. The patient experiences a pleasing exhilaration, due probably to the combined action of the alcohol and $C\,0_2$°.

It favors sleep at night without leaving any after-headache." *

(The writer would, with diffidence, offer a remark here with regard to the diuretic properties of milk and some milk products. The diuresis is not, in his opinion, due to a drainage from the kidneys of an excess of fluid, but to a special diuretic action of milk sugar. He has noticed this increased flow of urine in himself and in his children after the administration of the milk sugar). Wanklyn gives the following analysis of koumiss : †

FULL KOUMISS.	
Water	87.32
Alcohol	1.00
$C O_2$	0.90
Solids	10.78
	100.00

THE SOLIDS CONTAINED	
Casein	2.84
Lactose and Lactic A.	6.60
Fat	0.68
Ash	.66
	10.78

This analysis was made when the koumiss was 48 hours old.

SAME KOUMISS AFTER 6th DAY.	
Water	88.47
Alcohol	1.60
$C O_2$	1.50
Solids	8.43
	100.00

SAME KOUMISS AFTER 35th DAY.	
Water	89.16
Alcohol	1.80
$C O_2$	1.50
Solids	7.54
	100.00

SOLIDS NOW CONSISTED OF	
Casein	2.57
Lactose and Lac. A.	3.82
Fat	.50
Ash	.65
	7.54

MILK AS A CAUSE OF DISEASE.

Milk may communicate disease to man in several ways : It may undergo alterations, fermentative in character, through the presence of lowly forms of life, and thus acquire poisonous

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* Bartholow, "Mat. Med. & Ther." pp. 24, 25.

† "Milk Analysis," p. 64, *et seq.*

properties; it may be the vehicle by which vegetable or mineral poisons are introduced to the human stomach after having first, so to speak, been filtered through the cow. It may carry to mankind germs of certain diseases having origin in the lower animals; and lastly, it may, after being drawn from the body, act as a carrier, and possibly as a culture liquid, for diseases affecting only the human species. It is important that we should bear in mind that the death rate does not depend so much on diseases well known in character, whose origin can easily be traced, as on the pernicious lowering of the vitality of the mass of the people through causes ill ascertained or obscure. It is not sufficient to say that the milk from a fevered animal has not been proven directly noxious; it cannot be normal milk, therefore its influence on health, though slight, is on the wrong side, and its use should be forbidden. Boards of health should take pains to keep themselves informed as to the sanitary condition of the cattle furnishing the milk supply in their jurisdiction; and the use of milk from diseased cattle, or of milk from farms where scarlet fever, enteric fever, measles, diphtheria, or other contagious diseases are present, should be forbidden until it can be shown that only the milk from sound cattle is utilized, or that there is no danger of the supply being contaminated by disease germs or excreta from sick persons.

One good step in this direction would be to prohibit the keeping of dairies within the limits or in the immediate suburbs of cities. Here, crowded for room, with insufficient drainage, ventilation and sunlight, it is impossible to keep healthy cattle. Dr. Miller, of Camden, and the writer, found many cows in stables of this description giving plenty of milk and eating well, but with accelerated respiration and temperature of 103° F. These cattle, when sick, are milked as long as milk can be drawn from the udder, are stuffed with grains (and those often in a state of decomposition) to increase the yield, and it is more by good luck than good management if the water supply is not contaminated by human or animal excreta; and it is rare that some water does not find its way into the milk; and as the limited space afforded by city and suburban lots ensures the milk being kept within the walls of the dwelling, the chances of contamination are great indeed.

The owners generally come from a dirty and ignorant element of our foreign population, to whom cleanliness represents the unattainable. If any one thinks this picture overdrawn, let them visit some of these places and judge for themselves.* So long as these city dairies cannot be suppressed every obstacle should be thrown in the way of their establishment. They should be registered and licensed, should be compelled to report promptly all cases of disease in their cattle or their family, and every infraction of the sanitary code promptly punished by fine, publication or revocation of the license.

DISEASED MILK.

Blue Milk.—Two distinct varieties of blue milk have been observed; in one, the milk is blue when drawn from the cow, it is of low specific gravity and throws up but little cream, and the blue tint can be distinctly seen through the cream after it has risen.

This variety of blue milk is not injurious to health, and is supposed to be due to cattle eating certain plants, as mercurius perennis, myosotis palustris, polygonum, aviculare, etc. The second variety of blue milk is fungoid in origin, and is in some parts of Europe a veritable scourge to the dairyman. In Normandy, Picardy, Artois, Holstein and the Marches of Brandenburg it has assailed the milk product over wide stretches of country. The milk appears healthy when first drawn from the cow, and the period antecedent to the first change has varied from eight to forty-two hours; the cream becomes speckled with circular points and patches of an indigo-blue color, these gradually extending on and beneath the cream until the milk is uniformly blue. Hot weather is necessary to the development of this condition, and it ceases with the first frost. Kept long enough, the milk becomes covered with a rough white layer of the fungus, the blue becoming grayish blue, then gray, and finally of a dirty white hue, the cream becoming frothy from the evolution of gas. The whole of the milk in a dairy is not at first attacked, but as time goes on the condition becomes general, and as the fungus may be carried in the air, one farm after another may become affected by it. Infusoria and monads are rapidly developed in the milk, and are most numerous in the blue patches. The reaction of the coagulated milk is less acid than usual, the casein is charged with the coloring matter, and is less consistent than in healthy milk. The color may be communicated to the whey but not to the butter.

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* The writer was called to attend a patient where, on a lot 20x80 feet, were congregated seven human beings, one horse, one cow, three pigs, one goat, a number of ducks, geese, fowls and rabbits, and several dogs and cats.

Causation.—Braconnet attributed it to the cryptogam byssus cœruleus, Ehrenberg to the vibrio cyanogenus, later authorities to the oidium lactis, or "penicillium." Furstenberg has kept the fungus for more than a year without loss of its activity, its addition to milk at the end of that period being promptly followed by its reproduction. Haubner states that the coloration is confined to the albuminous envelop of the fat cells. If the milk be rendered alkaline the blue color is replaced by red or yellow, the after addition of acid restoring the original color. The influence of food on the change is not clear, though it is said that soil-covered, or mouldy forage favors its development, green clover, lupulin and lucern have been blamed for it, also the use of green forage after the dry food of winter, though from our knowledge of its fungoid origin, it would seem that these could only operate as the carriers of the proper cause.

It is also stated that congestion of, or hæmorrhage, into the mammary gland favors its development.

Therapy.—Change of pasture, cleanliness, disinfection of the dairy utensils (washing the pans, pails, hands, teats, etc., with weak chlorine water is recommended). The milk is of disagreeable taste, and gastritis and diarrhœa have followed its use. According to Grawitz, oidium lactis passes through the following stages of development: The conidia or spores, which are oval cells, lengthen out into one or more germinal tubes, which very soon become jointed and throw out lateral branches; these branches are at first cylindrical, but later become rounded off and appear as lengthened ovoids. Sooner or later these break up by transverse subdivision into chains or chaplets of conidia. The several conidia cells then recommence the developmental cycle, which proceeds as before. No true sporangia or spore capsules are formed, and no kind of sexual reproduction has been observed.*

Red Milk.—This, like the blue milk, may have a dual causation, *i.e.*, entrance into the milk of a coloring substance from the vegetation, or the presence of a fungus. Parmentier produced the first variety by feeding madder; when thus produced, it is probably innocuous, although its appearance would interfere with its sale. The second variety shows itself by the development of red patches in the layer of cream. It is usually seen in dirty dairies in bad weather, and its use has given rise to dyspepsia, choleraic attacks, and (in children) apthous affection.

Yellow Milk has also been observed, and oftentimes the yellow patches precede the formation of the blue. It has been attributed to the vibrio xanthogenus.

Green Milk is probably due to a mixture of the blue and yellow vibrios. The constituents of the bile and urine have been found in milk (due to faulty action of the liver on albuminoids?) and milk from cows affected with phthisis is said to be calcareous.

ABNORMAL FLAVOR.

Bitter or Rotten Milk.—This has a bitter, mawkish taste, and most disagreeable odor ; it is very difficult to make butter from it. The condition is probably due to bad housing, keeping, or adulteration with water containing decomposing animal matter.

The writer found a most execrable fecal odor in milk shipped in new cans; it was said by the dealer, a milkman of experience, to be due to the ingredients used in soldering the cans. It must not be forgotten in this connection that milk readily absorbs any odorous particles coming in contact with it, and every care should be taken to keep the milk house or cellar sweet and clean.

Sweet Bitter Milk.—This taste may be given to milk by the cattle feeding on vine or chestnut leaves; but in the form we are about to consider, the peculiar taste is not observed until the cream begins to rise. Fermentation proceeds in an irregular manner, and the cream has in places a yellowish color, not unlike that of soup made from split peas; the rest of the cream may be natural looking, though dirty. The cream is frothy, and drops of oil appear on the surface of the milk (due to rupture of the fat cells or disintegration of their envelopes). The milk tastes remarkably sweet, this being succeeded by a bitter after-taste; the same peculiarity of taste is noticed in the casein. If the milk is kept for some time the taste becomes rancid, from splitting up of the fat; the odor is now disagreeable, and the milk soon becomes putrid.

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* Ziegler's "Pathology." W. Wood & Co., p. 318.

It is very difficult to make butter from it, and if any is obtained it is tenacious, and resembles mucus of objectionable flavor, and quickly grows rancid; indeed, both butter and cheese made from this milk are uneatable. In inflammation of the udder blood or pus may find its way into the milk, and the same thing may happen when cattle are inoculated for contagious pleuro-pneumonia, blood or pus from the tail dropping into the pail. The red color due to blood may be recognized by the microscope, or the spectrum of hæmoglobine may be recognized if the cells are ruptured. Milk of this description is unfit for food. Taylor was consulted in a case where bloody milk caused vomiting and other symptoms of irritant poisoning in three children.* (The description of diseased milk is mainly condensed from Fleming's "Manual of Veterinary Sanitary Science and Police," to which the reader is referred if a fuller account is desired).

MILK AS A VEHICLE FOR POISON.

Many poisonous and medicinal substances are excreted by the mammary glands, and milk may in this way convey them to persons or animals partaking of it. The custom of purging the infant through the milk of the mother is too well known to need comment. Gentian, aloes, and other nauseous drugs impart not only their taste, but their medicinal properties to the milk of the animal taking them; and the veterinarian must exercise discretion as to whether it is permissible to use milk from cattle when they are undergoing medicinal treatment. It is fabled that the habit of intoxication to which the Emperor Nero so immoderately yielded was owing to the influence thus exerted by a drunken nurse.* M. Jacquemin examined the milk of a cow which had been severely wounded at pasture; the wound had been dressed with carbolic acid, and he detected carbolic acid in milk drawn from the cow.† In a cow suffering from lead poisoning Taylor found traces of lead in the milk a few hours after the poison had been swallowed. ‡

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* Taylor on "Poisons," 3d Am. ed., p. 515.

Milk may also become impregnated with lead through being kept in badly-glazed pans. "A young woman who was taking tartar emetic for pleurisy suckled her infant, and it was observed that the child was attacked by a fit of vomiting after every attempt to suck the breast." § The case given by Dr. Fayrer ("Thanatophidia of India," p. 43) of a child dying from serpent poisoning taken in with the milk from its mother is in opposition to what is known relative to the action of this poison when taken into the stomach, and is probably to be explained by the existence of abrasions on the lips or in the mouth of the infant. Gueuther found antimony in milk after feeding the tartrate to a cow. Harms observed a hæmorrhagic diarrhœa in two dogs and three young goats after feeding them with the milk of a cow which had been given forty-six grains of tartar emetic the day before. Klink demonstrated the presence of quicksilver in the milk of a woman afflicted with syphillis after inunction of mercurial ointment. A large number of persons in Rome were poisoned by the use of goats' milk; the disease, as it appeared in these people, was strongly characteristic of cholera. The goats were healthy, but had been fed on conium maculatum, clematis vitalba, colchicum autumnalis, and plumbago europea. Some of the vomited milk showed the presence of colchicum. ‖ The writer saw a valuable Jersey calf poisoned through drinking milk from an old paint keg.

As cattle have a habit of picking up and swallowing nails, bits of metal, paint skins, etc., care should be taken that they are not pastured where they can get at them, as in the neighborhood of rifle butts or chemical works.

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* Dewees on Children. 11th Ed., p. 165.

† Taylor on Poisons. 3d Am. Ed., p. 55.

‡ Taylor on Poisons. 3d Am. Ed., p. 55.

§ Christison on Poisons. p. 483.

‖ Billings' Relation of Animal Diseases to the Public Health. p. 61.

The Influence of Mental Emotion on the Secretion of Milk.—Instances are on record which show that mental emotion may so modify the mother's milk that it becomes dangerous to the health or life of her progeny, and the nursing child will often accurately reflect the shades of the mother's temper. A child was attacked by convulsions after being suckled by a nurse who was at the time suffering from a fit of anger.* Sir Astley Cooper observed two cases where great mental emotion was followed by arrest of the secretion. Carpenter relates the case of a bitch whose puppy was seized with convulsions after sucking the enraged mother. Dr. Milner Fothergill quotes from Carpenter † the case of a woman who interfered in a quarrel between her husband and a soldier who was billeted on them. She snatched away the man's sword, broke it, and taking up her healthy infant, who was sleeping in the cradle, gave it the breast. In a few minutes the infant left off sucking, panted and fell back dead on the mother's breast. It is clear, says Carpenter, that the disordered secretion produced some very active poison, acting on the nervous system. Dewees gives the case of a child almost moribund from infantile diarrhœa, no amelioration was obtained until the mother, who had suffered from toothache, had the offending tooth removed. The child then recovered.‡

DISEASES OF THE LOWER ANIMALS RENDERING THEIR MILK INJURIOUS TO HEALTH.

Anthrax.—Goheir has seen milk from cattle affected with anthrax, cause anthrax, on more than one occasion. Chisholm saw a case of anthrax in a three years' old child, caused by drinking the milk from an affected cow, and it has, in like manner, been conveyed to the lower animals.§

Actinomycosis.—It is entirely within the range of probability that actinomycosis has been conveyed to man by means of milk containing spores of the disease, and the fact that of the sixteen cases tabulated by Johne three had local lesions in the mouth points very strongly in this direction.* (Actinomycosis, gr. *actis* a ray, *mycos* a fungus)—a disease most common in cattle, transmissible to other animals and to man, caused by the presence of a vegetable parasite, recognizable under the microscope by the ray-like arrangement of its spores. Its most common seat is on the jaw of the ox or cow, or in the substance of the tongue, where it occurs in yellow masses looking not unlike inflammatory products which have undergone caseation.

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* Evanson & Maunsell on Children. 2d Ed., p. 39.

† Indigestion and Biliousness. p. 99.

‡ Dewees on Children. 11th Ed., p. 275.

§ Fleming, Manual of Vet. Sanitary Science and Police. Vol. 2, p. 20.

Rabies.—Authorities differ as to the possibility of transmitting rabies through the milk. Dolan says † "Milk may be used until symptoms of disease are manifested, may be given to animals, and owners may use it. People have remained healthy even after using milk at the commencement of the disease, but our researches prove that both flesh and milk are dangerous after the malady has developed."

Mr. Steele states ‡ "Two ewes were bitten by a rabid dog, rabies appeared in them about six weeks afterwards, and they were killed. One had two lambs, the other one; at first these lambs were allowed to suckle. They were subsequently attacked by rabies and were killed. It appears highly probable that they received the poison through the milk because they were removed from the ewes a month before they (the lambs) became affected, and there was no proof that they had been bitten." Billings says § that "the consumption of flesh and milk from diseased animals is not harmful," but as the immunity would probably depend on the possession of an intact mucous membrane along the alimentary tract, it would seem best to avoid it.

Foot and Mouth Disease.—The transmission of eczema epizootica to man through the medium of the milk has been placed beyond doubt by the experiments of Hertwig. "He drank daily for four consecutive days a quart of milk from cows having the disease. On the second day he observed a mild fever, pains in the limbs, headache, a dry and hot throat, and a peculiar sensation in the hands and fingers. These mild phenomena continued about five days, then the lining of the mouth became swollen, especially the covering of the tongue; in a short time vesicles began to develop, and at the same time that these eruptions appeared on the mouth and lips, an eruption of like character was observed on the hands and fingers." Two medical friends of Hertwig subjected themselves to like treatment with similar results. Young animals drinking the milk perish from gastro-enteritis, and Bollinger quotes cases of infection to man by the use of buttermilk.[*] "It is especially from the vesicles on the teats that the poison may escape and mix with the milk, which, if drank warm, induces inflammation of the fauces, irritation of the alimentary canal, and even eruptions of the skin." [†] Simmonds and Brown have given the disease to pigs and cats by feeding them with the the milk. The milk is harmless when boiled.

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* Fleming. Actinomycosis. p. 35.

† Rabies, or Hydrophobia. p. 218.

‡ Taylor on Poisons. 3d Am. Ed. p. 55.

§ Rel. Animal Dis. to Public Health. p. 141.

COMPOSITION OF MILK IN ECZEMA EPIZOOTICA. [‡]

Water	88.1
Fat	2.9
Casein	3.4
Lactin	5.48
Ash	68
	100.56

Milk Sickness, Trembles.—In some portions of the Southern and Western States—notably among the fertile valleys and coves of the mountainous regions of Kentucky, Tennessee, North Carolina and Georgia—the cattle are liable to the above named disorder, and may, through the medium of their milk, communicate it to man or the lower animals. The districts infested by it are seldom more than a few miles in extent, located in valleys or coves, on the north side of a mountain. The sun shines on these but a few hours daily, if at all; the soil is rich and full of moisture, the trees gigantic and interlacing overhead, the atmosphere damp and chill, like that of a deep cellar. A well-marked symptom in cattle is an incapacity for muscular exertion, and this is so characteristic of the disease that suspected cattle are always sharply driven before slaughter. The disorder lasts from seven to ten days in cattle, and it is stated that they are never attacked if kept off the pestilential districts until the dew has risen. The symptoms and post-mortem appearance in cattle are those of gastro-intestinal inflammation.

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[*] Billings. Relation of Animal Diseases to Public Health. p. 55.

[†] John Gamgee. Veterinarian Vade Mecum. p. 216.

[†] Smee, on Milk in Health and Disease. London, 1875. p. 110.

In man, the symptoms somewhat resemble those of typhus fever, and the post-mortem appearances are destruction of the epithelium along the digestive tract, with ulceration and suppuration, the gall bladder distended with inky bile, the liver softened, the spleen enlarged, and its contents grumous.*

Causation.—It is probably due to the presence of some undiscovered parasite; the fact that the cause disappears with the rising and returns with the falling dew is presumptive of such origin. It has been attributed to feeding on the rhus toxicodendrun, white snake root and eupratorium ageratoides. Hooker has seen a similar disease in New Holland, and attributes it to the cattle eating certain leguminous plants belonging to the genera "gmopholobium."

The poison has an affinity for oil and is removed from the milk to the butter by churning.

Tubérculosis (Perlsucht).—Considerable discussion has arisen as to the possibility of the transmission of bovine tuberculosis to man. The fact that it has been transmitted to other animals by means of the milk is strong presumptive evidence that it may be given to man in like manner, and as direct experiment is of course out of the question, we must be satisfied to secure and carefully weigh all the evidence we can accumulate.

The experiments of Gerlach and others prove that it is easily and promptly transmitted to pigs, rabbits and guinea pigs.

Creighton says † "There is little doubt that the pearl disease, modified only in the relative development of the process in various organs, has been communicated to animals by experiment. "There is evidence also that it has been communicated to animals by accident. Has it ever been communicated by accident to man? There is no lack of reasonable presumption that it has. The analogous disease of the horse (glanders) is now and then communicated to man, but we are brought in much closer contact with the bovine than with the equine race. "Besides bread, there is hardly a more universal article of diet than cows' milk. There are many more tuberculous cows than glandered horses, and it would take a good deal to reassure us that we do not sometimes partake of their tainted milk. Such arguments are plausible enough, but they do not prove that bovine tuberculosis ever has been communicated to man. I do not see how such communication can ever be proved, except by the evidence that the form and structure of the morbid products are the same as those of the bovine pearl disease." Under what names then have we been speaking of bovine tuberculosis in the past? First and foremost, there are the sudden and unaccountable onsets of tuberculosis both in children and adults. There is a growing conviction that such cases are due to the introduction of a specific virus into the body, and it is a question of morphological evidence whether in any particular case the morbid products are those that would be due to the specific bovine virus. It is the evidence of identity in form and structure that I have dwelt so much on in this work, and I would claim no case of tuberculosis in man as a case of communicated bovine tuberculosis unless I found on the serous membrane (especially on the sharp margins of the lungs and on the under surface of the diaphragm), or in the lymphathic glands, or in all these together, and occasionally in other parts or organs, those evidences both of form and minute structure which are distinctive of the bovine disease as it exists primarily and specifically in the cow. The deposits in perlsucht are most commonly found on the serous surfaces in cattle, the mesentery, omentum, peritonium and pleura, often containing many pounds of them. The lungs in many of the cases coming under my notice have been invaded late, the difficulty in respiration being often due to the enormous infiltration of the bronchial lymphatic glands, and not to changes in the lung substance. In one case the axillary glands were affected to such an extent as to produce serious deformity in the region of the scapula humeral articulation. In this case I was sent for to *reduce a dislocation of the shoulder joint*, and the owner was very indignant when told that the animal had tuberculosis. A post-mortem examination in this case showed almost every tissue and organ of the body affected in some degree. Oftentimes the first outward and visible sign of the disorder is mastitis, and the veterinarian must very carefully exclude tuberculosis in making a diagnosis in these cases. I have seen two instances where the consumption of tuberculous milk was followed by symptoms of lung trouble and general wasting. The cow was destroyed in each case (in one she had been procured to furnish milk for a delicate lady and her infant) and the symptoms in one instance were removed. In the other case I lost sight of the family. Physicians attending cases of threatened tuberculosis should always investigate the condition of the cows furnishing the milk supply to the patient, or have a competent veterinarian do it for them.

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* Dickson's Elements of Medicines. 2d Ed., p. 488.

† Bovine Tuberculosis in Man. p. 101, *et seq.*

DISEASES PECULIAR TO THE HUMAN SPECIES WHICH MAY ME CARRIED IN MILK.

Mr. Ernest Hart has collected and tabulated fifty epidemics of enteric fever, fifteen of scarlet fever and seven of diphtheria which have been traced to milk poisoning.* Where enteric fever is conveyed the medium is usually contaminated with water used to wash the cans or adulterate the milk. Scarlet fever is more likely to be propagated by the desquamating cuticle getting into the milk. Mr. Powers concludes that therefore though a connection between diphtheria and the consumption of milk has not been proven as yet, still it is very likely indeed. His careful investigations into the cause of some local epidemics in North London, exclude any other source from which the people could have been affected.† Greenhow says: ‡ "The contagion of scarlet fever or smallpox may undoubtedly be conveyed from place to place by means of clothing *or other articles* which have been in contact with the sick, but no such instances of the transmission of diphtheria have come under my notice." Mackenzie says:[*] "In many cases of diphtheria which I have seen during the last few years, the drinking water was found to be contaminated with excrementitious matter." "The poison may be received into the system through the water that is drunk or food that is eaten." Smee quotes the case of the orphan asylum at Beddington, where an outbreak of enteric fever was traced to the milk supply.

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* Parkes Hygiene. W. Wood & Co. Vol. 1, p. 285.

† Jacobs on Diphtheria, p. 64.

‡ Greenhow, on Diphtheria. London, 1860, p. 148.

One morning one of the children brought to the matron a tadpole found in her mug; the dairy was changed and the outbreak at once ceased. (Smee on "Milk in Health and Disease.) It would be easy to multiply instances of this kind, but it would serve no purpose.

We know these diseases are transmitted through milk, and it is the duty of the physician to investigate the milk supply in all doubtful cases.

LEGISLATION RESPECTING MILK.

New York State.—Prosecutions for the sale of impure milk are conducted under the food adulteration act. The State Board of Health have adopted as the limit 11.5 total solids with 2.5 fat (the English standard). In New York city prosecutions are carried on under the sanitary code of the Board of Health, which prohibits the bringing into, offering for sale, or selling in the city, any milk from which anything has been taken or to which anything has been added. The lactometer, based on a specific gravity of 1029 at 60° F., is used to detect watered milk, but an analysis of skim milk is made, and when the fat falls below 2.5 per cent. skimming is inferred. Four sanitary inspectors have charge of the work, and are authorized to destroy all impure milk.

Massachusetts—State law authorizes cities and towns to appoint milk inspectors, but Boston and Cambridge are the only places where inspectors operate. Any milk falling below 13 per cent. total solids is considered by law as impure. Punishment by fine and publication. (The food adulteration act now in force requires only 12 per cent. solids).

Rhode Island—State law authorizes appointment of inspectors. Standard 12 per cent. solids, 2.5 per cent. fat. Penalty $20. Providence is the only city enforcing the law.

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[*] Mackenzie, on Diphtheria. London, 1879, pp. 11, 16.

New Jersey—Law requires 12 per cent. solids, and prohibits the sale of skim milk in cities of the first-class. Where skim milk is sold in other places it must be carried in cans stamped "Skim Milk" in letters two inches high. The penalty for the first offence is $50; for the second $100, with forfeiture of the condemned milk. The sale of milk from cows fed on distillery swill or other unwholesome food, or of milk exposed to the emanations from contagious diseases is prohibited. Cincinnati, Cleveland, Syracuse, Paterson and Newark, N. J., have local laws, some of them including inspection of the dairies.

ART. IV. — AZOTURIA, MORE ESPECIALLY WITH REFERENCE TO ITS NOMENCLATURE AND PATHOLOGY.

BY RICHARD W. BURKE, M.R.C.V.S.
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SYNONYMS. — Hæmoglobinuria (Bollinger), Hysteria (Haycock), Azotœmia, Acute Uræmia (Walley), Neurasthenia Acuta, or Acute Nerve-Tire (Burke).

Various theories have been advanced to explain the pathology of this affection, and opinions still appear divided among the various observers. The most favorite are, renal inadequacy and liver derangement; but the explanations given by supporters of either theory appear to be a little conflicting. Their contention, if we understand their position aright, is that in this disease there is an imperfect conversion of albuminous substances, due to functional disorder of the liver, or to excessive supply of albumen, or to both these factors, which leads to an excess of urates in the blood, defective elimination by the kidneys, and an increase in the quantity of uric acid and urates in the blood. The admission that pre-existing defective capacity of the kidneys or disease of the liver will promote the development and accelerate the symptoms of Azoturia becomes an unavoidable corollary.

But the almost complete exclusion of what follows in the course of the above changes, in the production and distribution of the morbid phenomena, introduces difficulties which to me appear to have been hitherto left unexplained, and which may be called the alpha and omega of this whole process. The central fact remains, therefore, very nearly where it always was, since the main points unfolded by the above theories, and examined and re-examined by successive writers, have made little progress in comprehending what solutions of the problem are justifiable and true. Consequently we receive from writers an elaboration of their own hobbies, or whatever it may please each inquirer to call the result of his own investigation. Such theories, even though they may be universally accepted as a working hypothesis, yet show there is much need for an objection to them.

There are ample reasons for thinking that changes in the nervous centres determine the locality of each symptom in Azoturia, while changes in the relation of the blood, liver, and kidneys determine its effects. We may adopt for ourselves, then, the *neurotic theory*, since disturbances in the nervous system, in some form and part, may be regarded as a factor in every case of Azoturia. Dr. Laycock's "Lectures on Diseases of Organs and Tissues as influenced by the nervous system" bear directly upon this subject of Azoturia, and I would recommend their perusal in this connection.

We know how functional derangement produces certain definite conditions of temperament, or rather we are sure as of anything that "certain constitutions are prone to functional derangements of certain glandular organs, both secretive and eliminative, which alter the actual constituent normal condition of the blood," which is made manifest either in an objective or subjective manner; and there can be no doubt that cause and effect, and effect and cause, both work together in the production of that unstable and irritable state of the nerve centres, which tends to a pathological state known as "Azoturia ' in the horse. From an analysis of all the symptoms noticed in this disease I am confident we can find an explanation for the majority, if not all of them, which is especially marked out as nervous or neurotic.

With reference to the term Acute Uræmia, which implies that the blood is the starting point of the disease, it is known that numerous experiments performed on dogs and rabbits have proved that the subcutaneous injection of varying quantities of urea is followed by no one symptom, or symptoms, belonging to the disease which has been named by veterinarians *Azoturia;* while the experiments of Grèhaut and Quinquad have proved that similar injections of urea, equal to one-hundredth of the weight of the body, are always followed by death, without producing any symptoms of uræmia in the above animals. The presence of a large quantity of urea in the blood of animals does not seem to exert any injurious influence in producing the symptoms of this disease.

The presence of urates in the urine is secondary, — a result of organic changes due to altered innervation; whilst albumin in the urine is not always present, and may be frequently produced, not only in the urine, but in the saliva and some other secretions and excretions, by the injection of various therapeutic agents. Semmola,* Vulpian, Dessales and others have shown that after hypodermic injections of pilocarpine, for example, the saliva, bile, and other secretions become richer in albuminoid substances coagulable by nitric acid, though none was to be found before the injections. In nephritis, in paralysis agitans, and other nervous disorders, albumin has been traced more or less in all the secretions. M. Strauss rendered the urine of animal albuminous by pricking the fourth ventricle, or by injecting glucose under the skin, but the kidneys did not present any organic lesions.

The connection of nerve disorders with uterine complaints is well known, and this may again explain perhaps the relative frequency of Azoturia in mares as compared with geldings or stallions. It would be a great mistake, however, to conclude that there is any necessary or constant connection between the two; for, although very frequently the nerve disorder has originated in connection with uterine disturbance, in a large proportion of the cases we have seen it has developed independent of it, as in males.

I have no hesitation in asserting it to be my firm belief that many of the incurable cases of progressive muscular atrophy (especially of the crural muscles and occasionally of the muscles of the scapular region), paralysis, and many other diseases of the nervous system, commence as Azoturia; and when in this state are quite amenable to treatment. Death is usually the result of some sequela in severe cases.

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* Annali Univ. di Medicina, Feb., 1885.

What are the usual characteristics of such subjects? Can they be described as weak, debilitated, and weedy looking? Certainly not; and the experience of practitioners of human medicine agrees with our own in an especial manner; for Dr. J. Stretch Dowse* describes such patients as being usually "robust, stout, plethoric, and apparently cheerful." Dr. W. S. Playfair † writes that occasionally such patients are "overburdened with an excess of adispose tissue." At a recent meeting of the balneological section of the Gesellschaft für Heilkunde, held in Berlin this year, Dr. Joseph, of Landeck, read a paper upon this subject, describing the condition of neurasthenic patients as "robust, muscular, and ruddy complexioned."

Among the drugs which have given most relief in cases of Azoturia, and which have been found reliable in our hands, we find the following, and I enumerate them in the order of their value, namely: chloral, opium and morphia,‡ belladonna (Walley) and atropine, chloroform, bromide and iodide of potassium, ergot, turpentine, quinine, ether, alcohol and ammonia; and, I would add, local friction (*massage*) and electricity. The reflex influence of mechanical stimuli of the cutaneous nerves on the cerebro-spinal circulation is of considerable importance.

I am tempted to put forward the above facts, because it is one of the most remarkable instances of the strange and multiform phenomena which neurotic disease may present, which it has ever been the lot of veterinarians to witness. Coincident with nerve disorder is the change in the constitution of the blood, due to changes in the secretory and excretory organs, particularly the liver and kidneys. On the soil so prepared are often developed the graver symptoms, such as paresis, or paralysis, hyperæsthesia, disorder of motion, hystero-epileptic seizures, convulsions, and many others which must be familiar to us all in dealing with such cases. The muscular tremors, the cramp, the unsteady gait, the loss of balance, &c., so marked in many cases, may be due to the nerve current from the cerebellum in its descent to the muscles finding an obstacle in the spinal cord altered by the morbid process.

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* Dr. J. S. Dowse, "On Nerve-Prostration." 1880, p. 11.

† Dr. W. S. Playfair, "On Nerve-Prostration and Hysteria." 1883, p. 91.

‡ Journal of Comparative Medicine and Surgery. April, 1885.

ART. V.—GEORGE FLEMING, LL.D.,F.R.C.V.S. PRINCIPAL VETERINARY SURGEON TO THE BRITISH ARMY.

Fleming was born at Glasgow, on March 11, 1833. Early in life he showed a natural taste for animals, and was of a studious turn of mind. These two qualities combined, directed him to apply his talents to veterinary science.

Professionally, he commenced life as a pupil with the late Mr. A. Lawson, with whom he worked for two years, before entering the old veterinary college, Clyde Street, Edinburgh; where he studied under the late founder of the school, Professor Dick. During his collegiate life he spent his vacations with the late Mr. John Lawson, of Manchester, in whose extensive practice he had an opportunity of observing the various details of the "Art and Science" he chose to study. Whilst a student at Clyde Street he obtained the medals for Chemistry, Materia Medica, Anatomy, Essays, the best General Examination and the Fitzwygram Prize for practical Knowledge. He qualified to practice Veterinary Medicine and Surgery by obtaining the certificate of the Highland and Agricultural Society of Scotland in 1855.

As soon as he had graduated he was offered an appointment in the Army by the late Mr. Wilkinson (then Principal Veterinary Surgeon to the Forces), which he refused, preferring to go into private practice at Burnley, in Lancashire. Six months after this Mr. Wilkinson again urged him to join the army, and he complied with the request, intending to return to his practice after the Crimean war was finished, in 1856. However he soon found that the life of a soldier was far more pleasant to his active, jocular disposition, than the humdrum and worry of a private practice ; so he made up his mind to remain in the army. In 1859 he volunteered to serve in the expedition to North China, and was present at the capture of the Taku Forts, and the different actions leading to the surrender of Pekin; he remained in China until 1861. During his stay there, he and a friend made a very hazardous journey beyond the Great Wall of China, a description of which he afterwards published in the shape of a book entitled "Travels on Horseback in Mantchu Tartary." This was the first book he wrote. In 1867 he served in Syria. He has served in the Third (King's Own) Hussars, Royal Engineers, and the Second Life Guards In 1879 he was appointed Inspecting Veterinary Surgeon at the War Office, which post he held until His Royal Highness, the Duke of Cambridge, Field Marshal, Commanding-in-Chief, offered him the appointment of Principal Veterinary Surgeon to the British Forces, in 1883, and we hope his health will be preserved so as to enable him to carry out the duties, which we are confident will in the end be advantageous to the veterinary profession and the department of which he is Principal.

Although Fleming was leading an active life as a soldier, still this did not prevent him exercising his talent for study and the advancement of his profession. He was constantly contributing articles on veterinary and the allied sciences to various periodicals,

In 1863 he read two papers before the members of the British Association, at Newcastle-on-Tyne. One on the "Geography of North China," the other on the "Ethnology of that Country."

In 1866 he presented himself for and passed the examination for the Diploma of the Royal College of Veterinary Surgeons. The following year he was elected a Vice-President of that body, when he proved to be so able and useful that in 1868 the profession elected him a member of their Council and they have re-elected him every time his office has expired. In 1880 the Council selected him to occupy the most distinguished position in the English profession, viz.: PRESIDENT OF THE ROYAL COLLEGE OF VETERINARY SURGEONS. He carried out the duties so efficiently that they kept him in office until 1884. He has also been a member of the Examining Board, for the Diploma of the R.C.V.S., since 1872.

His official duties have been no sinecure, for he has been most attentive to the welfare of the profession—watching with a keen eye the movements of those whose objects were anything but those most beneficial to the profession as a whole. He has always striven to improve the educational standard and the examinations of the student in every way. He has also strenuously endeavored to maintain the supremacy of the Royal College of Veterinary Surgeons over the colleges (teaching schools). So much has the latter been the case, that in 1875 Fleming gave up contributing to the then solitary existing veterinary periodical, and founded and edited one of his own, (The Veterinary Journal). His reasons for so doing being in our opinion ample and justifiable, as may be seen by any one who will take the trouble to refer to his editorials in the 1st number (July, 1875). The only portal by which members should be admitted as efficient to practice a profession, *in any country*, should be controlled by the profession itself, and not ruled by any section of it; and Dr. Fleming has been one of the principal guardians of this maxim in England, much to the benefit of both members and profession.

One other great work he was instrumental in completing must not be forgotten, viz.: protecting the right of using the title "VETERINARY SURGEON." Before 1881 any person, whether educated or not, could call himself a Veterinary Surgeon. Now, however no person (except those who had been practicing the veterinary art for five years previous to 1881), can use the title of "Veterinary Surgeon,"—or any other designation which would lead the public to think he was qualified—unless he had passed the examination for the Diploma of the R. C. V. S.

All this gratuitous hard work, pecuniary expenditure, and labor of love for his profession, was recognized in a very feeble but genuine manner by its members presenting him on two different occasions with testimonials. Not only has his profession acknowledged his great works, but we are pleased and gratified to know that others have done so also. Various learned continental societies have conferred their honors upon him, whilst those outside the profession have not forgotten him at home. It was only in 1883 that the University of Glasgow (his native town) recognized the veterinary profession for the first time in its history by conferring upon him their honorary degree of Doctor of Laws. In recognition of the papers he read before the British Association in 1863 Sir R. Murchison (then President of the Royal Geographical

Society) nominated him as a Fellow of that Society, and Sir Harry Parkes (then Minister to Pekin) seconded the nomination.

We could, if space and time permitted, say a great deal more; but sufficient has been done by himself to show his comrades in war of his abilities in the barracks, field and mess-room ; to his professional brethren, of his untiring energies to place their profession in the position it should occupy, and which we have little doubt it soon would occupy, had we a few score of of the 3000 M.R.C.V.S. as loyal to their profession and as energetic in accomplishing its advancement as he.

We should like to say something of the social side of his character, but as we do not think this admissible in a professional journal we will simply inform our American friends that in whatever sphere we have had the pleasure of meeting him—and that is not a few—we have always found him a jolly and lively companion, earnest and true friend, and a willing, generous assistant and adviser.

EDITORIAL DEPARTMENT.

Dr. Billings in Paris.—The subject which of all others absorbs most the attention of the public at the present moment is hydrophobia, and whether Pasteur's assertion that he has discovered a positive cure for the same by the inoculation of his prepared virus will be verified or not is the question most hotly discussed.

For some time past the illustrious Parisian, whose discoveries in bacteriology have spread his fame over the world, has devoted his entire attention to the study of rabies, its prevention and cure. At the Academy of Medicine in Paris he declared recently that his efforts were crowned with complete success. By inoculating rabbits from the spinal cord of an infected animal and cultivating through successive generations he has obtained cultivations of successively increasing virulence and shortened the period of incubation; and by keeping the spinal cords of these rabbits in perfectly dry tubes for varying periods he can obtain a virus attenuated as desired.

Our readers are acquainted with the circumstances which led to the sending of a number of children to Paris to be placed under the immediate care of the great *savant*, in whose laboratory the question will soon be put to a practical test. They will be pleased to learn that Dr. Billings has been selected to accompany the cases so timely sent from this country to assist M. Pasteur in the experiments and to note in detail the *modus operandi* thereof.

The mission of Dr. Billings is an important one, not only as regards the benefits to be derived by those immediately concerned and ultimately by suffering humanity at large, but also on account of its scientific interest to our profession, and that it will be, if successful, a demonstration of the value of experimental pathology. It will also probably result in the establishment in this country of an institution in which pathological research can be carried on as effectually as in Europe, and where mad-dog bitten unfortunates can be treated without being subjected to the delay and expense of an ocean voyage. In such event Dr. Billings will have obtained the necessary experience to organize and direct it. C.

THE PYRAMID TRACT.—In presenting an article on the comparative anatomy of the Pyramid Tract, from the pen of a leading American authority on the brain, we desire to direct attention to the fact, that it is intended to serve as a forerunner of a monograph on the brain of the horse, which is now being prepared by a well known veterinarian, on the basis of special anatomical and pathological investigations. There is some reason to believe that our veterinary text-books, in describing the symptoms of paralysis from brain disease in horses, follow certain conventional notions derived from text-books on human medicine, rather than actual observation on horses. It is true that, practically speaking, the elucidation of the subtler pathology of equine paralysis can scarcely hope to become as important a subject to the veterinarian as paralysis of the human subject is to the physician, since a paralyzed horse is, as a rule, permanently crippled and consequently doomed. Yet there are certain questions of diagnosis which may have an important medico-legal, if no other bearing. The determination of the nature of a poison, producing paralysis for example, may depend, during the life of the animal, on the type of the paralysis, whether this be spinal or cerebral. Now, what is the spinal as distinguished from the cerebral type of paralysis in the horse? Do any of our text-books satisfactorily answer that question? It is true that paralysis of one side (hemiphlegia) is represented in such works as the typical result of disease of one hemisphere, and paralysis of both sides is the usual result of disease lower down. But the determination by Professor Spitzka of the fact that the hoofed animals have no true pyramid decussation, is calculated to throw some doubt on the usually accepted criteria. In order to set these doubts at rest, the number of cases in which there is paralysis either of cerebral or spinal origin, cannot be too large. We therefore would ask our subscribers and other friends to carefully note cases of this character, to obtain autopsies wherever possible, and if they lack the time or inclination to make a minute analysis of the nervous apparatus, we shall be pleased to receive the specimens, and submit them to the investigator referred to. Full acknowledgment for histories furnished, and specimens sent, will be made. The latter should be removed from the animal shortly after death. The animal should be killed by bleeding, not by shooting or poisoning. The work of removing the brain and cord is difficult, but faithful compliance with such directions as Mr. McFaydean's work gives will enable the dissector to obtain them intact.

A large vessel, holding at least a gallon, should be filled with a solution of bichromate of potassa, of thirty grains to the ounce of water (about an ounce of the salt to each pint of fluid), or with the solution known as Muller's fluid. A layer of antiseptic cotton should be placed at the bottom of this vessel, and then the brain, or brain and cord, submerged in it. The membranes which surround the brain should be nicked with a scissors wherever accessible, particularly between the cerebellum and oblongata.

The spinal cord should be cut, under the fluid, crosswise into as many pieces as there are pairs of spinal nerves, each segment corresponding to one such pair.

After being preserved for one week in a cool place, undisturbed, the tin case is to be closed, soldered tightly, and sent by express to the Zoölogical Department of Central Park, New York city. If the distance be great, the jar is to be filled with soaked cotton, to prevent excessive shaking. C.

BARRY'S CLINICAL THERMOMETER.—We desire to call our readers' attention to the advertising pages where the above instrument is described.

The importance of accurately noting bodily temperature in fevers and inflammations which is so well established in human medicine is equally so when these conditions exist in animals. Every veterinarian then should possess a good thermometer, and we recommend this one as nearest approaching perfection.

THE PUTNAM NAIL CO., BOSTON, MASS.—It is generally by inattention to small matters in the care of horses that many valuable animals are lost. A nail is apparently an insignificant affair, yet a defective one will lame your horse. Great danger of lameness is often incurred in shoeing by using nails which split in driving. The Putnam nail is the only one in which this does not take place, and the most experienced horsemen concede it the highest place among nails.

TESTIMONIAL.—The Faculty of Students of the American Veterinary College, in acknowledgment to Dr. Billings, previous to his departure for Europe, of their appreciation of the interest always displayed by him whilst connected with their institution, presented him with a substantial testimonial of their kind wishes. C.

ERRATA.—In Dr. Plageman's paper on Colic in the October number of the journal, page 365, read Indigestion instead of Indisposition, Aliment instead of Element, Suppurative instead of Suppuration.

Proceedings Veterinary Medical Societies.

NATIONAL VETERINARY MEDICAL ASSOCIATION.

The third annual meeting of this Association was held at Washington, December, 15, 16, 17. Dr. L. V. Plageman, M.R.C.V.S., called the meeting to order. T. B. Cotton, V.S., filled the place of secretary, and Dr. Charles A. Meyer, recording secretary. Dr. Hamill, D.V.S., acted as sergeant-at-arms.

Drs. H, E. Earle, M.D.V.S., Richmond Co., N. Y.; Peter Peters, V.S., New York College Veterinary Surgeons; John H. Dancer, D.V.S., Oranget N. J.; C. B. Robinson, D.V.S., Wheeling, West Va. State Board of Health; James T. Bushman, M.R.C.V.S., Washington; Thos. L. Armstrong, V.S., Indianapolis; Robt. Ward, F.R.C.V.S., Baltimore State Board of Health; Wm. H. Dougherty, V.S., Baltimore; and John A. McLaughlin, D.V.S., Providence, were present.

Letters of regret were received from the following gentlemen:—Prof. Smith, V.S., Toronto; Wm. Shepard, V.S., Ottawa, Ill.; R. Jennings, V.S., Pittsburg, Pa.; J. F. Suttcliff, Port Jervis, N.Y.; Noah Cressy, M.D.V.S., New Haven, Ct.; John Lindsay, D.V.S., Huntington, L. I.; and Chas. B. Uibel, V.S., Lancaster, Ohio.

Dr. H. E. Earle, D.V.S., introduced the discussion on Humane Associations, and the efforts of Henry Bergh, of New York, in that direction were generally commended.

There was an animated discussion on the subject of vivisection, and the vivisection of animals was to a certain extent favored, with the reservation that those to be experimented upon should not be subjected to pain or torture. All the members favored the use of anæsthetics.

Various questions relating to contagious diseases were discussed, and all the delegates favored action by the association tending to secure better protection of live stock from diseases of a contagious type, and urged the advisability of appointing qualified veterinary surgeons to official positions. It was stated that stock-raisers and the general public are not fully aware of the extent of diseases of a contagious nature that are transmittable from one animal to another, and from animals to mankind, and *vice versa*.

It was stated that great numbers of valuable stock have been lost through lack of proper treatment, and the opinion was expressed that the appointing powers should confer with the National Association, and the various State organizations of which it is composed, as to the best means of securing better protection of live stock from contagious diseases.

Dr. Plageman read a paper on the diseased condition of the nervous system called "Hydrophobia." This term he said was a misnomer, the proper name being "Rabies." The paper advanced the theory of spontaneous generation. The compound hydrogen and nitrogen, commonly known as water of ammonia, was the only safe agent to employ in the case of wounds made by rabid dogs or animals. This water of ammonia being alkaline in reaction has the power of destroying the virus.

Dr. Hamill stated that hydrophobia was, in his opinion, a blood disease and not a nervous one; that it was a contamination of the blood acting on the nerve centres. There are also various diseases which resemble, in many of their symptoms, rabies.

The transmissibility of diseases was discussed by Drs. Meyer, Dancer, Peters, Earle and Hamill, and it was declared that the facts would in time demonstrate that vaccination for many diseases would be a preventive, or at least render them milder in type. Dr. Cotton stated that vaccination for splenic fever is now claimed by a practitioner in Canada as a preventive of that disease, and he had demonstrated the usefulness of his discovery before M. Pasteur had made his researches public.

Dr. Ward, Dr. Lyman, Dr. William Dougherty and W. H. Martinet, all of Baltimore, spoke on veterinary progress and the duties its practitioners owe to their patrons, and expressed themselves pleased to see that the several States were well represented by delegates who besides being veterinarians, were graduates of regular medical colleges, showing that there is a gradual movement toward uniting the two professions.

The last morning session was on a series of questions from the Humane Society of Pa., as follows:

PENNSYLVANIA SOCIETY FOR THE PREVENTION OF CRUELTY TO ANIMALS.

PHILADELPHIA, December 16, 1885.

DEAR SIR:—This Society is now engaged in endeavoring to arrive at the most humane method of slaughtering cattle, and with that end in view, I have been requested to ask your consideration and that of your Convention to the following queries:—

1st.—Does the Israelitish method of killing—"the quick cut of gullet and windpipe"—produce a total loss of sensation?

2d.—Does a total loss of sensation result from a blow upon the head of a bullock, with hammer or axe, given with sufficient force to knock the animal down?

3d.—What is the most humane method of slaughtering cattle?

4th.—Is a bullock so sensitive as to suffer terror or agony in witnessing the death blows to and sufferings of his companions?

If, in the important proceedings of your Convention, time can be found to consider these questions, your opinions and discussions of the subjects will tend largely to the proper solution of a question which covers a wide range of inquiry.

Very respectfully,

M. V. B. DAVIS, *Sec*

To the President of the Veterinary Convention, Washington, D. C.

The Convention decided in answer to—

Question No. 1—There is not a total loss of sensation.

Question No. 2—When properly delivered, and with sufficient force on the proper spot, then there is a total loss of sensation.

Question No. 3—The best method known to this body is known as the French method, which consists of a covering for the eyes with a block attached to it and on the forehead through which passes a bolt of sufficient length which is driven into the brain by a forcible blow with a mallet. then cutting the throat when felled, and bleeding immediately.

Question No. 4 - Animals are sensitive to the sufferings of others.

Dr. Charles A. Meyer, President of the N. Y. State Academy of Veterinary and Medical Pathology, read some interesting notes on Castration.

The emasculation of animals is one of the most common operations which the veterinarian is called upon to perform, and the custom has become almost universal, and in this country almost every male horse may be said to be a gelding, excepting those which are kept for covering, and these are mainly imported for the purpose.

Were all male horses left entire, many would be difficult to control, and life would be endangered. It is therefore a benefit to mankind that horses used for pleasure and servitude should be gelded, although the gelding no longer possesses that grace, action, form and carriage, which is so characteristic of the stallion.

By the operation of emasculation he degenerates into a comparatively mild and tractable animal, becomes reduced in stamina and constitution, and as a consequence more liable to disease; but we gain by making him a useful servant.

A brief history of castration may be of interest. The Egyptians knew the methods of gelding in a crude manner, and the Israelites and Greeks learned it from them. Cautery and ligature were the methods used. Aristotle mentions the mode of compression, whereby the testes of young animals were destroyed, but in older ones they were removed by excission. Aspyrtus remarks that in suckling colts the testes were destroyed by bruising between two blocks of wood or stones, and in older animals excission with a red-heated knife. Mago, a Carthagenian, applied split reeds to the cord, and gradually removed the testes by torsion, but in older animals applied the clämps below the epididymus, and removed the gland by excission. The method of scraping the cord, and in this way removing the gland, was practiced by the Indians, and it is claimed that through this channel it was introduced into England. The first knowledge we have of the clamps is described by Asinari, an Italian, although his ideas may have been derived from those of Mago, mentioned above.

It is not for me to discuss the different methods, as they all have but one object in view, to restrain the temper of the horse, and make him a docile servant. A few interesting observations and statistics of sequelæ, due to castration, will be mentioned.

Bouley's observations on forty-five entire horses, found that the testes of twenty-four were more developed on the left, sixteen on the right, and five equal in size. The smallest weighed two ounces, and the largest ten and one-half ounces. Hering operated on seventy-eight entire horses, aged from two and one-half to twenty-four years, and found that forty-four were larger on the left, twenty-six on the right, and eight equal in size, the smallest weighed one ounce three drachms, and the largest twelve ounces and two drachms; average weight of left testicle, seven ounces, two drachms, twenty-one grains; average weight of right testicle, seven ounces, one drachm, seventeen grains: differential average being in favor of the left, which is sixty-four grains. The following are a few statistics of sequelæ due to the operation: W. S. Adams' observations at a Remount Depot, where 10,305 animals were operated upon: 240 died, due to the operation; 116 from peritonitis, 76 gangrene, 22 hæmorrhage, 16 tetanus, 10 hernia. All were operated on by the scraping method. Peritonitis generally occurred from the third to the sixth day. Gangrene always produced a lingering death, and tetanus occurred between the fourth and twenty-seventh day. In 1856 a series of experiments were conducted by Messrs. Thacker, Shaw and Richardson. The ligature, actual cautery, caustic clamps, and the scraping methods were all tried, and resulted in favor of scraping. Lacoste,—in December, 1838, 177 horses were operated on in seven days, and with good results. On the week following, 62 were operated on, of which 42 died from peritonitis. In 1831, at a Remount Depot, 100 died, and in 1835, at Caen, 56 died from tetanus. From November 23, to December 6, 1847, of 74 horses operated upon, 32 had tetanus, of which 6 recovered. Dawson, Report of 1848,—290 were operated on by the scraping method, and no ill results. Gloay, in 1849, saw an experienced shepherd operate on 200 lambs, of which 160 died within three days.

Hurford, 1850, reported 144 operated by the scraping method, of which five died. Paton, in 1855, reported 120 mules operated by scraping method during a severe heated spell, and no ill results.

In the year 1830, a Russian, in Paris, removed the testes with his teeth, and in 1831 repeated the same performance at Viroflay. In Lapland the reindeer is delivered of his glands by old women, who gnaw through the cord with their teeth.

A professional castrator who went by the name of the "Pole," traveled to France, and located himself at Caen, where he introduced his method of castrating the horse while standing. This was in the year 1826; previous to this the torsion method was unknown in France.

This "Pole" used no means of restraint such as hobbles, ropes or twitch, but stood by the left side of the animal, near the hind leg, grasped the scrotum with the left hand, and with a knife in his right hand cut through the coverings of the testicles, seizing the protruding gland with his right hand, and with the thumb and fingers of the left he applied pressure enough to hold and gradually turned and twisted until the testicle was removed. He operated in the same manner on the other gland. Throughout the whole operation the animals remained very quiet. Mace, 1852, and Goux, 1849, operated on standing foals, applied the ligature and left the testes hanging.

The reason I mention the above facts are, that certain professionals claim the standing operation of torsion as their own.

It was first noticed in 1826, as mentioned above, the only difference being that the ecraseur is now used instead of the torsion process. The first use of the ecraseur and the gelding of horses while standing came to my notice in the year 1876. A professional castrator named C. D. House, operated in this part of the country, and in conversation with him he informed me that he had seen the operation performed in Kentucky, and there they applied the clamps on animals while standing. His success as an operator was great, and the method is now established throughout the country. The greatest castrator of these times is "Miles," of Illinois, and he has for years used the ecraseur. The scraping, the torsion, and the use of the ecraseur, are about the one and same process.

By the use of the ecraseur there is no bleeding from crushed or torn arteries, due to the complete and rapid plugging of the vessels by the turning inwards of the torn tunics, &c., and when properly used, wounds usually heal with very little local or general reaction, although under all methods sequelæ due to the operation, will happen, and with which every practitioner has to encounter, and there is none that hurts or blasts a reputation more than a case of unsuccessful castration.

It is for this reason that many veterinarians refuse to geld, especially when permanently located; they prefer the traveling professional, and treat or care for the consequences which often happen, such as pain, inflammation, hæmorrhage, peritonitis, enteritis, tetanus, gangrene, schirrus and hernia.

It is conceded by all authors and operators that many animals are predisposed to peritonitis, tetanus and sclerous cord. Climatic changes have a marked influence and many instances are recorded of these facts.

My opinion, as regards the use of the ecraseur and the standing position, is that they are far superior to other methods for the following reasons: That there is not so much liability to subjecting the animal to a nervous shock; it is done quicker, with less pain to the patient, and does not cause injury or fractures as when thrown.

The paper was ably discussed by the delegates, and a vote of thanks accorded the reader.

Dr. Thos. L. Armstrong, V.S., stated that he was called to Morgan Co., Ind., to attend on 17 mules about two-year olds, which had been operated upon with the wooden clamps. After the operation they were turned out, all crossed a stream about four feet deep, to pasture on the opposite sides, in about ten days after they showed signs of tetanus, five of which died in a few days; the remaining twelve, whose symptoms were slight, were placed in an isolated barn, and no one permitted to see them except the groom who cared for their wants. Twice a day morphine was given in the drinking water, of which they were allowed to partake as much as they choose, and strict orders to keep the place and surroundings quiet. The twelve gradually recovered.

T. B. Cotton, of Mount Vernon, Ohio, was called to see eighteen animals which had been castrated with the wooden clamps, applied by an experienced operator of twenty-four years, who claimed never to have lost a case in all those years, and that season, of the eighteen operated upon, all died.

In 1883 he saw a well known and experienced operator geld eight horses, two bitches, some chickens and ducks in one day. The first one operated on was suffering from strangles. After the first operation he operated on all the other animals. Six of the eight horses died from blood poisoning, two slowly recovered, and how the other animals fared he did not know; the ecraseur was used, and the cause was inoculation from the strangles patient as he did not clean the instrument.

C. B. Robinson, V.S., stated that Prof. McEcheron, of Montreal, Canada, advised his students never to castrate monorchids, as the practitioner might be censured, should any patient die after the operation of castration.

Dr. J. H. Dancer, D.V.S., Orange, N. J., reported sixteen horses operated on by a professional castrator, and well known throughout Pennsylvania, they were owned by a wealthy stock raiser, and nine of them died.

Dr. L. V. Plageman, M.R.C.V.S., castrated a great many, and with good results. He was called to operate on three horses, two-year-olds and owned by one gentleman, and the three died within four days. Operated with clamps and actual cautery.

Dr. H. E. Earl, of Richmond County, N. Y., always operated with the ecraseur, and has so far always had the best results.

Dr. Robt. Ward, F.R C.V.S., cited cases, and stated that there was danger in the operation, by any method. He had for years been a co-worker with Prof. Geo. Fleming, of London: advised the use of the ecraseur, used it himself, and it was advocated by all the English schools.

A motion was made and carried that the ecraseur be recommended as the most scientific instrument for castration, known to this body.

In the afternoon of the last session the delegates convened in Baltimore, Md., to listen to an elaborate discourse on "Milk," by Dr. R. Ward.

The following officers were elected for the ensuing year: President-James Hamill, New York; first vice-president, T. B. Cotton, Mount Ver, non, Ohio: second vice-president, H. E. Earle, West New Brighton, N. Y.; third vice-president, C. B. Robinson, Wheeling, W. Va.; recording secretary, T. L. Armstrong, Indianapolis, Ind.; corresponding secretary, Peter Peters, New York; treasurer, L. V. Plageman, Brooklyn, N. Y.; trustees, Charles A. Meyer, John A. Dancer and H. E. Earle.

The Convention decided to hold its next meeting in November, 1886, at some city in the State of Ohio, to be decided upon by the President.

CHARLES. A. MEYER, D.V.S., *Rec. Sec.*

VETERINARY MEDICAL ASSOCIATION OF NEW JERSEY.

The sixth regular meeting of this association was held at the West Jersey Hotel, in Camden, Thursday, December 10, 1885.

The President, Dr. Wm. B. E. Miller, in the chair. The following members were present: Drs T. B. Rogers, of Westville; H. W. Rowland, of Jersey City; J. W. Hawk, of Newark; C. K. Dyer, of Mount Holly; W. P. Smith, of Trenton; L. R. Sattler, of Newark; J. C. Dustan, of Morristown; W. P. Humphrey, of Elizabeth; M. A. Pierce, and Wm. Herbert Lowe, of Paterson.

Among those present as visitors, were Drs. T. C. Sanford, of Asbury Park; F. W. Hilyard, of Mount Holly; W. H. Williams, of Fellowship, and Wm. H. Iszard, M.D., of Camden.

Dr. Smith proposed Dr. L. P. Hurley, of Camden, for membership, and Dr. Lowe proposed Dr. E. R. Mercer, of Montclair. The names of both gentlemen were referred to the Board of Censors, who reported favorably, and they were duly elected. Dr. Dyer, proposed Drs. T. C. Sanford, of Asbury Park and F. W. Hilyard, of Mount Holly. The Board of Censors did not report in regard to the two last named candidates. Action to be taken at the next regular meeting.

Two of the honorary members, Dr. E. M. Hunt, Secretary of the State Board of Health, and Dr. Julius Gerth, State Veterinarian of Nebraska, sent letters regretting their inability to attend. A letter of regret was also received from Dr. W. H. Pendry, Secretary of the N. Y. State Veterinary Society.

The Treasurer's report was presented and accepted.

The new Constitution and By-Laws, prepared by Dr. Lowe since the incorporation of the Association under the Act of the Legislature for the advancement of Veterinary Science and Art, were presented by him. Their consideration occupied most of the first session, but they were finally adopted substantially as prepared. That portion entitled *The Code of Ethics*, caused much discussion, but was adopted to read as follows:—

"It shall be regarded as a grave offence for any member to speak disrespectfully of another, or by insinuation or otherwise to injure his reputation or professional standing. It behoves each member to do as he would wish to be done by, and to cultivate that sense of honor and propriety which should invariably distinguish the professional man. As the Association aims to protect the privileges and immunities of its members, it is expected that they will exercise their abilities in extending and enriching the domain of comparative medicine and surgery, and in advancing the interests of the profession."

"No veterinary physician should prescribe for a patient having been treated by another member of the profession unless the former has relinquished the case, or that the owner announces that he has dispensed with his services."

"In case of consultation, the consulting veterinarian should, so far as he can do so conscientiously, sustain the surgeon in charge of the case, and in no way either by word or act, promote his own interests at the expense of his brother practitioner. He whose practice is based on an exclusive dogma, or who rejects the accumulated experience of the profession, or ignores the aids of anatomy, physiology, pathology and organic chemistry, shall not be considered a fit associate in consultation.

"While it is essential for the veterinarian consulted to ascertain the true nature of the case, he should carefully withhold all discussion of the subject till his brother practitioner and himself meet in private for deliberation. When a conclusion is reached, it will be the duty of the attending veterinarian to state the results to his client, in presence of the consulting veterinary surgeon. No opinions should be delivered which are not the result of previous deliberations and concurrence.

"When diversity of opinion exists, it may be proper to refer the case to several veterinarians, in good standing, or a court-medical. Still, in most cases, mutual concessions should render this unnecessary.

"All discussions in consultation should be confidential.

"Qualifications, and not intrigue or artifice, should constitute the foundation for successful practice."

"Any advertisement or announcement, beyond the name and address, shall be deemed unprofessional.

"Any advertisement or announcement of nostrums, secret remedies, panaceas, and all things of a like nature, shall be deemed unprofessional.

"The promising of radical cures, and the procuring of certificates regarding the same, or of operations with a view to advertisement would be deemed reprehensible. It is also reprehensible for veterinarians to give certificates relating to patent medicines, or promoting their use in any way.

"There is no profession whose members are more tempted to practice double dealing, than the veterinary, as for instance, in the giving of opinions regarding the purchase and sale of horses. Any member guilty of that offence shall be expelled from the Association.

"Any proposed alteration or amendment of the Constitution and By-Laws shall be submitted in writing to the Board of Trustees, and should their approval be given, action will be taken at the next regular meeting of the Association. A two-thirds vote will be necessary to confirm the same."

Prior to the second session the members of the Association visited the farm of Michael Feenfer, a milkman at Pavonia, near Camden. The object of the visit was to ascertain the sanitary conditions of the farm. Certain publications had been made by a human practitioner, Dr. C. R. Earley, of Ridgway, Elk Co., Pa., taking Drs. Miller and Dyer to task for an alleged want of professional knowledge, and as to their performance, or rather what he regards as the non-performance of certain duties in representing the State Board of Health. After making examinations the Association sustained the views and actions of Drs. Miller and Dyer. A committee consisting of Drs. Hawk, Smith and Pierce, were appointed to draft resolutions. They presented the following, which were adopted and signed by all of the members present:—

"We the special committee appointed by the Veterinary Medical Association of New Jersey, in session here this day, to draft suitable resolutions condemning the grossly outrageous article published in the *Sanitarian*, written by C. L. Earley, a physician residing at Ridgway, Elk Co., Pa., in which he attacks unjustly Drs. W. B. E. Miller and C. K. Dyer, do present the following:—

"*Resolved*, That we, as a veterinary association, do condem the article published as a malicious falsehood on these gentlemen, whose ability and standing in the profession is well known to all of us, and we endorse the actions of Drs. Miller and Dyer in their treatment of the herd at Mr. Feenfer's, at Pavonia.

"*Resolved*, That the Association having in a body visited the herd of cattle and premises of Mr. Feenfer, testify that they found them to be in a first class condition ; that the sanitary and ventilating arrangements were good.

"*Resolved*, That a copy of these resolutions be published in the Camden papers, and that one be sent to the *Sanitarian*."

Dr. Rogers, of Westville, read a paper vindicating Drs. Miller and Dyer.

Dr. Lowe paid a tribute to the late Dr. Weeks, of Paterson, before introducing the following resolutions, which were passed and ordered entered upon the minutes

"*Whereas*, the late Dr. Arthur P. Weeks was a worthy member of our Association. therefore be it

"*Resolved*, That we express our sincere sorrow for the loss of so true a friend of veterinary science ; and that we unite in deep sympathy with his relatives in their affliction.

"*Resolved*, That the death of our friend at the early age of 27 years, and especially as his young life gave promise of a highly useful and honorable career, we feel all the more deeply the present bereavement.

"*Resolved*, That these expressions of our sorrow and sympathy be recorded in the minutes of our Association, and that a copy of the same be forwarded to his family."

Quite a number of interesting cases were related, and views interchanged on the same.

Dr. Dyer moved that the Secretary be appointed a committee of one, with power, to take charge of such printing as may be necessary, including the new Constitution and By-Laws, Stationery and Certificates of Membership. It was so ordered.

The Association adjourned to meet in Morristown, the second Thursday of next April.

WM. HERBERT LOWE, D.V.S.,
Secretary.

OBITUARY.

PROF. HENRI BOULEY.

The sad news has reached us of the death in Paris of this eminent scientist, at the age of seventy-one.

At the time of his death he was President of the Academy of Sciences, Paris, the highest Scientific Society in Europe, and Inspector-General of the Veterinary Schools of France.

REVIEWS.

La Pathologie Comparée. Par le Dr. O. Larche. Paris, 1885.

The above is the title of an article taken from the "Dictionnaire Encyclopedique des Sciences Medicales," and published in pamphlet form.

The author calls attention to the advantages which the natural sciences have derived from the comparative method and to its well recognized utility in all branches of natural history, and proceeds to demonstrate its immense value in aiding pathological research.

The idea is not new, he says, but every day, in proportion as science progresses, observers are more and more convinced of its importance.

He appeals to the veterinarian to pursue his labors in observing and experimenting in the lower animals, thereby aiding by their results the efforts of their brethren in human medicine in obtaining a more complete knowledge of disease, thus repaying, in a measure, what they originally obtained from them.

The advantages of zoölogical gardens are dwelt on, and he urges the directors of them to make post-mortem examinations and dissect whenever an opportunity occurs. The value of experimental pathology is pointed out as shown by the labors of Pasteur, Burdon, Sanderson, Brown-Sequard, and others.

A brief history is given of comparative science, the best authors mentioned, its societies and museums, and the periodicals devoted to it. Of one of the latter he says: "Le Journal of Comparative Medicine and Surgery, qui paraît à New York, depuis 1880, est un Journal de Médicine Véterinaire, dans lequel une large place est dounée à la relation de faits observés sur d'autres animaux que ceux dont s'occupent specialement les véterinaires."

Reference is also made to articles on the subject by Dr. T. E. Satterthwaite.

The pamphlet contains thirty pages of interesting matter, which will well repay a veterinarian to peruse. J. O'L.

Post-mortem Examinations. By Prof. Rudolph Virchow. Translated by T. P. Smith, M.D. Philadelphia: P. Blakiston, Son & Co., 1885.

Here is to be found condensed in 140 pages, the early experience in autopsies of the most eminent modern pathologist, and his successful endeavor to develop a systematic method of conducting them. To the medical jurist it is invaluable, and its perusal will enable him to avoid embarrassing mistakes in noting post-mortem appearances. The veterinarian will find in this little book many valuable suggestions which will be of service to him in his dissections.

Physicians' Visiting List, 1886. Lindsay & Blakiston, Philadelphia.

This little book, now in its thirty-fifth year, is certainly the best Visiting List published. The present volume keeps up the high reputation sustained in former years, and needs no further commendation from us.

The Physicians' Magazine, published in Philadelphia, has taken up the subject of State Medicine, giving a synopsis of the annual report to the American Academy of Medicine, by Drs. R. J, Dunglison and H. O. Marcy, committee (read at the annual meeting at New York, October 29, 1885).

In this report a comprehensive statement of the actual progress made in the direction of medical legislation will be found. It contains the opinions on the subject of members of the medical profession in all parts of the United States—men who have taken an active part in protecting the public from quackery and fraud, and whose high professsional standing cannot fail to secure them a hearing in such important matters as those relating to human life and health. This subject has been ably treated by Dr. F. S. Billings, in a paper read before the meeting of the medical editors of the United States at New Orleans, and published in this JOURNAL for July, 1885

TRANSACTIONS OF THE STATE MEDICAL ASSOCIATION OF TEXAS, 1885.—The Seventeenth Annual Session of the above association was held in Houston in the month of April, 1885. The time has gone by when the expression "Gone to Texas," implied a benighted condition of that region. Now the *Lone Star* has taken her place with her sister States in the path of progress. As might be expected our professional brethren are not behindhand, and the book before us, judging from the address of the President and papers read, proves that they are doing good work in the interests of medical science.

BOOKS AND PAMPHLETS RECEIVED.

OUR LIVING WORLD, an artistic edition of the Rev. G. Wood's Natural History of Animated Creation. Published by Selmar Hess, New York.

THIRD BIENNIAL REPORT OF THE STATE BOARD OF HEALTH OF THE STATE OF IOWA. 1885.

STUDIES FROM THE BIOLOGICAL LABORATORY—JOHNS HOPKINS UNIVERSITY, BALTIMORE. Vol. III, No. 4. September, 1885.

BULLETIN OF THE ILLINOIS STATE LABORATORY OF NATURAL HISTORY. Index to Vol. I. Nos. 1, 2 and 3, Vol. II. Normal, Ill.

LECTURES ON THE SCIENCE OF AGRICULTURE. By Flavel S. Thomas, A.M., M.D. Hanson, Mass.

OBSERVATIONS UPON THE MUTUAL RELATIONS OF THE MEDICAL PROFESSION AND THE STATE. An Address delivered before the State Medical Society at Port Huron, Lansing, Mich.

AVENA SATIVA IN THE TREATMENT OF OPIUM ADDICTION. By J. B. Mattison, M.D. Brooklyn.

THE THERAPEUTICS OF HIGH TEMPERATURES IN YOUNG CHILDREN. By William Perry Watson, A.M., M.D., of Jersey City. Philadelphia: 1885.

FIRST ANNUAL REPORT NEW YORK CANCER HOSPITAL. 1885.

SIXTEENTH ANNUAL REPORT OF THE MANHATTAN EYE AND EAR HOSPITAL. New York: 1885.

DESCRIPTION OF THE HESPEROMYS TRUEI; A New Species belonging to the sub-family Murinæ. By R. W. Shufeldt, M.D., U. S. Army.

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ORIGINAL COMMUNICATIONS.

ART. VI.—RABIES IN THE DOG IN ITS RELATION TO RABIES IN MAN. WITH ESPECIAL REFERENCE TO ITS PREVENTION, AND TO PASTEUR'S SYSTEM OF PREVENTIVE INOCULATION.*

BY F. S. BILLINGS, D.V.S.

Rabies is the only word by which this disease should be designated in either man or animals. Hydrophobia is a misnomer with regard to the disease in either species. Neither dogs nor man when affected with this disease have any fear of water.

Dogs cross streams and endeavor to drink by dipping their mouths deep into vessels containing water. The rabied man longs and begs for it, but, with a shudder of frenzy, pushes it away, or demands it being at once taken from him because of the terrible sufferings which he knows will accompany any endeavor on his part to swallow it.

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* The statistics, and most of the references in the following pages are taken from Mr. Fleming's "Rabies and Hydrophobia," which is still the best book of reference to be had upon this subject.

WHAT IS RABIES?

Rabies is a contagious disease, *par excellence*, which apparently finds its origin in the canine (?) species only, and is imparted to other members of the same species, or to other warm-blooded animals by the bite of a rabid animal, most commonly a dog; the saliva being the vehicle of transmission, which holds the still unknown cause in suspension.

Like the greater number of our contagious diseases, in both man and animals, the primary origin of rabies is buried behind the myths and legends collected by the very earliest Hellenic and Egyptian writers. The most trustworthy author of this period, Aristotle, mentions the occurrence as a primary complaint in dogs, and its transmissibility to other mammalia, *with the exception of man.* The Greek and Roman physicians and authors that lived about this time did not make any such exception. We find many striking accounts of the terrible results of the bite of the mad dog in man, as well as many still more striking cures. It is not uninteresting to read that Pliny wrote: "When a person has been bitten by a mad dog he may be preserved from hydrophobia by applying the ashes of a dog's head to the wound," and, again, "Madness may be cured by eating a cock's brain." These passages indicate how old is the idea that the brain is largely the seat of the disease, but also that these early observers believed that the elements of rabid animals contained curative properties, as is still more evinced by the following passage: "There is beneath the tongue of the mad dog a certain slimy saliva which, taken in drink, is a preventive of hydrophobia." That this idea was not lost is evidenced by a quotation from an ancient MSS., or "Leech Book," written in the early part of the eleventh century. "A mad dog's head and liver, sodden, and given to be eaten to him who was torn, wonderfully healeth him."

THE NATURE OF THE CAUSE IN RABIES.

It is unfortunate that all our English veterinary works advocate the "spontaneous generation" of contagious diseases: in this regard Mr. Fleming says of Rabies, "there are few now-a-days who are not convinced that it will occasionally appear without any certain assignable cause." * Dr. Hammond, † also supports the spontaneous idea in a way which is scarcely in harmony with the general character of his admirable work. He says. "It is very probable that the saliva of healthy animals is, under certain circumstances, capable of producing hydrophobia in man or other animals."

The most exact study of this question under the light of to-day cannot discover a particle of evidence in favor of any such hypothesis or assertion.

Another most serious assertion that runs through the writings of nearly all medical writers on contagio-infectious diseases is that their etiological moment is a "poison."

A poison is a destructive agent, capable of isolation by the principle and methods of chemistry, having none of the attributes of life; *i.e.*, it cannot increase its own quality or quantity by the multiplication of its own elements; if introduced into an animal organism a poison can only be depended upon to act when a certain definite quantity has been given: if not fatal, the action becomes less and less as the poison is eliminated from the system by the appropriate organs.

How different is the action of the infecting elements in all contagious diseases, so far as we are acquainted with them! They are vital organisms; they have all the properties of life in their infinitesimal bodies: they take up nourishment and give off effete material: they can reproduce themselves in their own kind: no certain quantity is necessary would we produce a given disease with them. The smallest number of active spores that we can take up on the almost invisible point of the finest needle will produce anthrax in an inoculated animal just as surely as the countless numbers necessary to produce the smallest perceptible mass. They continue to live and reproduce so long as the body offers the suitable nutrition: the excretory organs have no perceptible influence upon their action or numbers. The infectious principle in rabies must have these characteristics, it must be a micro-organism. It must be held in suspension, not in solution, in the saliva.*

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* The above was written in 1872. There is every reason to think that this statement is not in accordance with the author's present views, for, at about the same time he advocated similar ideas in regard to glanders, but has since given them up entirely, and joined the contagionists.

† "Diseases of the Nervous System, 1881."

In that most unjust and mistaken publication, "Louis Pasteur: His Life and Labors," by his son-in-law, and translated into English by Lady Claude Hamilton, with the endorsement of Mr. John Tyndall, one may read among numerous other misstatements the following in regard to the discovery of a specific microbe in rabies: "This microbe of the saliva is very easily cultivated in sterile infusions, and successive cultures can be made in the usual way." "The virulence continues." "Thuillier has had the patience to make, in this manner, eighty cultures in contact, with the air, and eighty cultures in a vacuum, * * * The eightieth culture killed as quickly as the first," (p. 293).

On page 299 of the same book we find these statements are flatly contradicted, as follows: "For ourselves, as long as the cultivation of the microbe outside of the organism has not been affected, and that hydrophobia has not been communicated by means of artificial cultures, we shall abstain from expressing a definite opinion on the subject."

M. Pasteur himself, as well as his very able assistants, MM. Roux and Wasserzug, assured me that they had been thus far unable to isolate, color, cultivate or prove the existence of a specific microbe by direct experiment with cultivated material, either from the nervous substance or saliva of rabid animals.

Practical experience, as well as the thousands of inoculations that have been made with the saliva of rabid dogs, from the very earliest dates of medical literature, have all sufficiently demonstrated that the contagious principle is contained in it.

It was the result of the methodical observation of an exact scientist that led Louis Pasteur to look upon the substance of the brain and spinal cord as the tissues of the body in which the infectious principle would be most likely to be found in a pure state. As already said, notwithstanding the most determined research at the hands of such a master of bacteria staining and isolation as M. Roux is known to be, still there has been no discovery of any specific microbe at Pasteur's laboratory. On the contrary, Fol, of Geneva, has recently published (Jan., 1886), advance notes of the discovery of a coccus in the substance of the medulla which he claims to have stained by Weigert's method of using hæmotoxlin for nerve substance, with some peculiar modifications. He also claims to have produced rabies in rabbits with pure cultivations of the same.

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* I recently read an article in favor of the poisonous nature of the saliva, in which it was asserted "that in all cases where rabies followed the bite of a dog, it would be found that the animal had a hollow fang like a snake connecting with the sublingual gland.

This last assertion is sufficient to throw doubt on these statements. In order to prove what he asserts, Fol should have used dogs, and have produced genuine rabies in a series of these animals, or else have carried his supposed rabbit rabies to dogs, and proved the correctness of what must at present be considered an hypothesis.

As said above, Pasteur has shown conclusively that the substance of the brain and cord contains the infectious principle in an active and available form. In Fol's experiments it is stated that he used the fluid pressed out of the healthy brain of a sheep as a cultivating medium. When I first read the passage quoted from the life of Pasteur as to the cultivation of a "specific microbe" from the saliva of rabid dogs, I was at once struck with the brilliancy of such isolation, but soon lost my enthusiasm through the ensuing contradiction. That these unknown elements, are suspended in the saliva is beyond all question, but every bacteriologist must be fully aware of the extreme difficulty of isolating specific bacterium, especially such a minute organism, perhaps a coccus from a medium so full of micro-organism as the saliva of a rabid dog. These elements must be in the saliva, however, and in it before it enters the mouth, which indicates several practical experiments to be completed in the future.

1st.—To place a salivary fistula on the parotid ducts of a large rabid dog, and thence lead into appropriately sterilized vessels.

2d.—To make inoculations upon other dogs with such material.

3d.—To make cultivations from the same.

4th.—To use the parotid and sub-lingual glands in the same manner.

5th.—To try feeding experiments upon healthy dogs.
(a) With bread soaked in the saliva of rabid ones.
(b) With glandular substances.
(c) With brain and cord material.

6th.—That this parotid secretion, which can be obtained in any desired amount by placing a fistula upon the morbid ducts of cattle, offers the most natural material for cultivating experiments. It can be used in its natural fluid form by exercising great care in dissecting out the ducts, and at once leading the cut end into properly sterilized and closing vessels.

It can be prepared as a solid medium by treating it as in the preparation of blood serum, or as a gelatinous preparation for plate cultures by first carefully precipitating the albumen by heat (the degree necessary must be watched so as not to overdo it), and then adding gelatine as in the ordinary method of preparing meat-infusion-gelatine.

It would also seem advisable to again repeat the experiments that have been made with the flesh, milk and other tissues of rabid animals. That people have eaten such material, that rabid bitches have retained their affection for their young and suckled them until no longer able to do so, and no evil effects resulted therefrom, has been quite frequently observed. The ancients were certainly Isopaths in this direction, for we find that they recommend that persons bitten by rabid dogs should eat the liver or some portion of the same. I remember seeing quite an intelligent dog fancier cut a bull-dog open alive, that had just bitten him, and taking the beating heart out and splitting it open, bind it warm on the parts bitten, "in order to prevent hydrophobia," as he told me.

HYPOTHETIC CAUSES.

Among these may be mentioned *heat*, which finds its corroboration in the popular ideas connected with the so-called "dog days." No greater absurdity could exist. There is scarcely a doubt that rabies extended over Europe with the Roman armies, and thus became domesticated in the northern parts and Britain. Dogs have undoubtedly been the one great active element in its extension to other countries. When Mr. Fleming wrote—1872—it was not known in Australia, New Zealand, and various insulated portions of the world. It is not certain that it has ever extended to the Arctic regions. It has been reported that it did not exist in Constantinople, but Ahmed Effendi, Professor of Veterinary Medicine in the Military Academy at Constantinople, stated at the International Veterinary Congress at Vienna, 1865: "That in the East—Turkey—the disease exists, etc." It is, however, singular that there is so little of it there when we consider that the semi-wild dogs of that city are the public scavengers, and are continually growling, snapping and fighting over their filthy plunder. It frequently occurs in Algiers and Mexico, and less so in South America.

Our recent experience in this country shows that if nothing else, we can have local attacks of rabiphobia in our people in winter, notwithstanding the evil repute of the hot months. Statistics do not seem to favor the warm months, as is shown by the following, with regard to dogs admitted as rabid or suspected at the Veterinary School, Lyons, France, during the year 1865:

	Rabid.	Suspected.	Became Rabid in Hospital.	Total Number admitted.
January,	12	2	0	14
February	14	4	1	18
March,	6	11	0	17
April,	14	20	1	34
May,	12	14	1	26
June,	6	14	1	20
July,	2	8	2	10
August,	7	3	2	10
September,	1	3	0	4
October,	3	1	0	4
November,	0	0	0	0
December,	1	1	1	2

One of the absurd ideas which found advocates for many years was that, because there are so many more males than females, the former could not indulge their sexual passions sufficiently and hence got mad.

Neither want of water, ill-treatment, pampering, nor any one of the many things that have been asserted to play an etiological role in canine rabies have anything to do with it.

RABIES DUE TO NATURAL INFECTION.

Limiting ourselves to the consideration of canine and human rabies, and in consideration of the late rabiphobia over our country, it may be well to introduce this subject by statistics.

In and around Paris there have been for years an average of about 150,000 dogs, about one-third of which are licensed. The number of actually rabid dogs admitted to the Veterinary School at Alfort, for a period of ten years, was:

1853,	11
1854,	3
1855,	16
1856,	20
1857,	17
1858,	19
1859,	17
1860,	20
1861,	37
1862,	32.

19.1-5 dogs a year out of 150,000.

There are no statistics as to rabies in dogs in any part of the United States. The following, however, kindly furnished me by Professor Liautard of the American Veterinary College, are not without instructive interest. They include every dog that has died of rabies in that institution from the year 1874 to February 10, 1886.

Admitted,	November,	1875,	1 spotted	dog, died of rabies.	
"	August,	1876,	1 terrier	"	"
"	September,	"	1 "	"	"
"	October,	"	1 spitz	"	"
"	February,	1879,	1 pug	"	"
"	March,	1880,	1 spotted	"	"
"	September,	1881,	1 pointer	"	"
"	"	"	1 bull	"	"
"	November,	"	1 terrier	"	"
"	April,	1882,	1 spitz	"	"

The mortality from rabies in human beings for a term of years in England is given in the Register General's Reports thus: "From the years 1851–1867, inclusive, the number of deaths from rabies to the million inhabitants was:"

1851,	1852,	1853,	1854,	1855,	1856,	1857,	1858,	1859.
1	0.8	0.6	0.9	0.1	0.3	0.2	0.1	0.2
1860,	1861,	1862,	1863,	1864.	1865,	1866,	1867,	
0.2	0.2	0.05	0.2	0.6	1.	2.	0.5.	

Not one person in a million died of rabies in a year in a country where there has been known to be, at almost all times, much more canine rabies than we have ever had actual knowledge of in this country. At that ratio we do not have over 25 deaths from rabies in over 50,000,000 people in a year.

Is it not time that sensationalists were either confined or fined, for producing the nonsensical alarm we have lately gone through?

The following, taken from the Paris letter to the New York *Medical Record,* dated December 18th, 1885, bears especial relation to the questions at present under discussion:

> "Rabies, which, during the period from 1880 to 1884, diminished in Paris in a notable manner, had become more prevalent at the end of last year, and has continued with scarcely any abatement to the present time. From the commencement of the present year twenty cases of death from the disease have already been registered in Paris, and this figure is the highest that has yet been attained. In consequence of the alarming increase of such a terrible malady, M. Leblanc proposed, at the meeting of the Academy of Medicine, last week, that the following measures should be carried out: 1. That the law of July, 21, 1881, which prescribed the declaration of all cases of hydrophobia, the destruction of all animals bitten, the wearing by dogs of a collar of a certain kind, and the taking to the pound those that are found straying. 2. To render general and uniform the organization of the service of epizootics, and to place this service under the direction of veterinarians. 3. To cancel the adjournment of the article of the law forbidding empirics to treat animals affected with contagious maladies. To these propositions, which were unanimously accepted by the Academy, M. Le Fort added another compelling owners of dogs to attach to the collar a small medal bearing a mark showing that the tax had been paid for the year. All dogs not wearing these articles will be treated as stray dogs. M. Dujardin-Beaumetz, in supporting the conclusions of M. Leblanc's report, pointed out the difficulties in carrying out these regulations. M. Dujardin-Beaumetz has been charged for the last five years to search for cases of rabies among the population of Paris. In his report he observed that, as the spontaneousness of rabies is universally denied, the governing bodies are bound to enforce such police regulations as may be necessary to prevent the spread of the disease. It would appear that these regulations are strictly enforced in Germany, where hydrophobia is by no means so common as it is in this country, and even in Great Britain. According to M. Dujardin-Beaumetz's report, there were in Paris,. in 1881, 17 cases of death from hydrophobia; in 1882, thanks to the measures that had been taken, there were 11, and in 1883 there were only 6. In 1884, no case of the disease occurred in the first half-year; in the second half 3 cases were reported. In 1885, 20 cases have been registered to the present date."

The Secretary of the State Board of Health of Massachusetts reports that "there has not been one death a year from this cause in the last 30 years, and for the last 3 years not one."

Were it not for the terrible tortures to which our race is liable from the bite of a rabid dog, or were the disease strictly limited to that species of animal, rabies would not be a disease worth considering a moment in comparison with consumption that kills ⅐ of mankind; pleuro-pneumonia that has cost us millions and threatens our entire cattle interests; hog cholera, that costs us at least $30,000,000 annually; trichinosis, that costs us one-half our pork export business, and during the month of January, 1886, is reported as having attacked 42 of our citizens; tuberculosis, that has almost ruined many cattle breeders, and is a constant source of danger to our cattle interests and to ourselves as consumers of beef and milk.

Experience has proven that the danger to the person bitten varies considerably with the condition of the part of the body attacked, whether it be covered or exposed. Bouley indicates the influence as follows: *

Bites on the face, fatal, 90 per cent.
" " hands, fatal, 63 per cent.
" " clad limbs fatal, 29 per per cent.

In every contagious disease there is what is termed a period of incubation, *i. e.*, the time which elapses between the inception of the infectious elements and the period at which they first begin to manifest themselves by certain local or general disturbances.

This period of apparent inactivity is also known as that of latency. In rabies, the same is marked by an uncertainty and irregularity unknown in connection with any other contagious disease. The reason is absolutely beyond our present means of elucidation, hence any attempt at theorizing over it would but show our own weakness. During the latent period the individual bitten shows no bad symptom. The wound heals remarkably well. In some cases pain has been reported for a few days, or even constitutional disturbances, but the latter, in human beings, are more probably the result of anxiety than of direct irritation in the trauma. This period of latency has also been called that of the localization of the infecting principle. The latter is at present an hypothesis, but we may yet be able to offer substantial evidence of its correctness. In no disease is this phenomenon so striking as in rabies. In none is there so much reason for assuming that there are some peculiar conditions, or perhaps, biological necessities, in connection with the etiological moment which under such localization is probable. I do not think it has anything whatever to do with the organism bitten, but, to restate it; the localization of an infecting principle must be sought in the biological idiosyncrasies of the medium itself.

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* That the greatest circumspection is necessary in handling the cadaver of the rabid dog, or in making autopsies, or in the use of any materials which have been in contact with such an animal, is evident to every one, but to make it more so, the following examples are appended. Youatt, relates of a man becoming rabid and dying from untying the knot in a rope with his teeth, by which a mad dog had been tied; he also tells of a woman that died of the disease from pressing the seams made in her dress after repairing rents torn in it by a mad dog. A. Mr. Lawrence mentions a case of a lady dying from rabies from letting a pet poodle lick her chin upon which there was a pimple. Fleming mentions numerous cases of a similar nature.—*Watson's Practice of Physics.*

There are the most extreme divergencies in the reports of authors as to the extent of this period, more especially with regard to rabies in man, the time varying from six days[*] as a minimum to seven years.[†] The first extreme is so very rare as to be doubtful,and the second is deserving of still more skepticism ; in fact, reported cases of rabies in man of over a year's duration require the most exact revision. The following are some statistics as to the period of incubation in the dog.

Lafosse	gives	the two	extremes,	from	7	to	155	days.
Roell	"	"	"	"	21	"	70	"
Youatt,	"	"	"	"	17	"	210	"
Blaine,	"	"	"	"	21	"	50	"

But Blaine has also observed cases extend to 150 days.

Peuch gives reliable cases as occurring in 10, 15, 18, 22, 24, 26, 35, 88 and 95 days.

Renault gives a list with regard to 63 dogs.

Rabies developed in

1	dog	in from	5	to	10	days.
4	"	"	10	"	15	"
6	"	"	15	"	20	"
9	"	"	25	"	30	"
10	"	"	30	"	35	"
2	"	"	35	"	40	"
8	"	"	40	"	45	"

7	dogs	in from	45	to	50	days.
2	"	"	50	"	55	"
2	"	"	55	"	60	"
4	"	"	60	"	65	"
1	"	"	65	"	70	"
4	"	"	70	"	75	"
2	"	"	80	"	90	"
1	"	"	100	"	118	"

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[*] Hammond. [†] Fleming.

Saint Cyr gives a similar table which gives the minimum period of incubation as 16, and the maximum as 115 days, or an average of about 33 days. The statistics as regards man:

Romberg gives the shortest period of incubation as 15, and the longest as 270 days.
The average (England) period of incubation has been 40 days.
Tardieu mentions 26 cases that occurred in less than 30 "
" " 93 " " " " 30 to 90 days.
" " 19 " " " " 90 " 180 "
" " 9 " " " " 180 " 365 "

Of 86 undoubted cases.

17 occured in 30 days.
57 " " 30 to 90 days.
6 " " 90 " 180 "
6 " " 180 " 360 "

It will be thus seen that the period of incubation in natural infection does not vary much in dogs or man, though we do not find the extreme limits mentioned with regard to the former that we do in the latter.

As is well known, there were six children and quite a number of dogs, six of which have been recognized and securely confined, bitten by a *supposed mad dog* on December 2, 1885, in the city of Newark, N. J. It is not necessary to recapitulate the nature of these wounds, a few of which were on the hands, but the majority were on the limbs, where the teeth had to penetrate through thick clothing. It will be remembered what intense excitement was created and sustained for some six weeks over the incident. That there were grounds for the same may be found in the facts that during the summer and fall a very reliable Newark physician had had two cases of fatal rabies in human beings ; the actions of the dog that bit these children were also so unnatural as to warrant the strongest suspicions as to its having been indeed rabid. In biting, ugly dogs generally attack, shake and tear another dog or object with some persistency, but the dog in question did none of this: the children and dogs bitten were in different parts of the city, but all in the path taken by the dog in his travels. That the animal was suffering from intense cerebral excitement there is no doubt: he snapped at the children, gave them a quick, sharp bite or two, and went on his way, only attacking objects directly in his path. He was finally killed and made away with without any satisfactory autopsy having been made.

As nearly three months have now elapsed since the children and dogs were bitten, there are the strongest reasons for assuming, as well as hoping, that the serious apprehensions entertained were groundless, especially as neither of the bitten dogs or the two children that were bitten, but not sent to Paris, have not shown a single constitutional disturbance since the event. Where so serious a case is found to be unwarranted we should learn from it to exert the greatest circumspection before giving support to the cry of "mad dog," and "hydrophobia," and thus create an unnecessary alarm which is always liable to be followed by untoward results in timid and sentimental people, especially if they should be accidentally bitten by any dog at such times. Such sensationalism, which was only too largely supported by many physicians, only to gain notoriety, is opposed to the spirit of exact science, and brings not only it, but the entire medical profession, into disrepute and distrust.

PREDISPOSING CAUSES AND PROTECTING INFLUENCES.

That the different species of animal life have a varying degree of receptivity, as well as different individuals of the same species, to the infectious principle of a given disease is well known.

With regard to rabies, however, there is much reason to think that the degree of non-receptivity, or constitutional immunity, is not nearly so great as has been generally assumed. Leaving all treatment of the wound out of the question, it is known that by no means 50 per cent. of the persons bitten by rabid and suspected dogs acquire the disease when we disregard the seat of the wound. Renault places this percentage at 33 per cent. Hertwig reports that of 137 dogs bitten in the streets of Berlin, in a given period, by rabid or suspected dogs, *but* 16 *became rabid.*

Renault claims that one-fourth of the animals directly inoculated with saliva from rabid dogs, escaped the disease.

Hertwig received positive results in 14 out of 59 dogs—23.7 per cent. treated in the same manner. In some cases he found several inoculations necessary, and his celebrated bull-mastiff was resistent to all inoculations for a period of three years, although seven other dogs died o frabies from the same material.

A general review of such inexact statistics as exist will show that about two-thirds of the individuals bitten by rabid or suspected dogs never acquire the disease, while by intentional inoculation, as said above, about one-fourth escape. It must be remembered that these inoculations, whether natural or artificial, have all been made with the saliva: also that there are innumerable circumstances which tend to mitigate against any constancy in the virulence of this material. Pasteur has, however, shown us that in the brain and spinal cord of rabid dogs we have a material which, on being artificially introduced into the sub-meningel space of the brain in healthy dogs has an unfailing constancy of action. The same is true of rabbits and guinea-pigs. On the other hand, that there is a special idiosyncratic, or partial immunity (even for such constantly active material as above-mentioned) in some of the mammalia, has been shown by Pasteur, to exist in monkeys. Other animals have not been tried to any great extent.

DURATION OF RABIES.

In 131 cases of genuine rabies the average duration of the disease was five days: the shortest period was two days in the case of seven of these dogs; seven days in the case of two; nine days in two others, and thirteen days in one. In man, the shortest time reported is *one* day; the longest, twenty days. In 234 cases the average duration of the malady was four days.

PATHOLOGICAL ANATOMY IN THE DOG.

As in the majority of diseases which essentially complicate the nervous system the macroscopical pathological anatomy is very unsatisfactory. The microscopical is still more so, the specific microbe has not yet been discovered; nor have any lesions been described which can be depended upon as pathognomonic to this disease.

A fact, probably more or less unknown to the majority of pathologists that have only worked upon lesions in man, is that the brain and cord in the healthy dogs are invariably more hyperæmic and reddish than in man, and also that the cross-section of these organs reveals a peculiar glance and transparency which in man would lead to the suspicion of a slight degree of hyperæmia and œdema.

In rabies, these conditions are ex-acerbated. Effusion into the cavities of the brain and cord, and in the meshes of the lepto-mervieux is by no means rare. That the lungs, liver, kidneys and intestines should be more or less hyperæmic, with ecchymotic conditions is not surprising.

A phenomenon which requires the greatest circumspection in expressing a conclusion as to the existence of rabies in a given case is the presence of foreign material in the stomach of a dog. The mere presence of straw, grass, horse manure, shreds of carpet, or chips in the stomach is not sufficient to warrant the diagnosis of rabies. When united with a very suspicious history; when the mucosa of the digestive tract, from the mouth to the anus, is intensely congested, and the seat of more or less tumefaction, with hæmorrhagic centers dispersed through it; when the fauces are swollen, parched and covered with a viscid adhesive mucous; when the stomach is intensely swollen; when there are extensive hæmorrhages into its substance, and the stomach contains a coffee-colored, hæmorrhagic mass in connection with all sorts of abnormal material then, and only then, can we begin to think of rabies with certainty.

The mucosa of the respiratory tract will generally be found in a similar condition. Lesions of the tongue and lips are to be looked upon with the greatest suspicion. The bladder is generally empty. It is highly important that this whole subject be again gone over, and subjected to all the new methods of pathological investigation.

PROPHYLAXIS, PASTEUR'S METHOD OF PREVENTIVE INOCULATION.

A critical study of the work of Louis Pasteur teaches us a lesson which must be learned in this country before we can ever hope to see original research receive support and become as it should be, a blessing and credit to our people. As with the completion of every great scientific work, we shall find that no one man has ever completed all the work upon which they depend.

First.—Pasteur had never been successful without the monetary support of his government.

Second.—Science develops by steps. Pasteur has brought to a certain degree of completion five tasks in his life that will remain monuments to his genius. He has been over forty years devotedly working at his mission. The managers of a certain laboratory erected in New York, and said to be devoted to original research (?), lately announced that within the next six months four original papers will appear which will represent original work done in Cargnegie Laboratory.

Compare such wonderful abilities with the forty years' devotion of Pasteur, with the twenty years' work of Robert Koch, which has resulted in two original works!

How insignificant such men appear in comparison with our American products. Even the world's mightiest Virchow must look upon us with envy, and Darwin rest uneasy in his grave! The dust of Aristotle must even seek to resume its original form again before such soul-inspiring abilities as we have here in New York.

What is original work?

Such as moves the wheel of progress one cog forwards, or more, so that it remains and does not rotate back again.

As already mentioned, the author of the "Life of Pasteur" almost entirely overlooks the work of others in the same fields of research. When reading of his investigations in connection with anthrax one is almost led to think that Pasteur had done about almost all, and no mention is made of the original discoverers of bacillus anthracis, his countryman Dovaine, or the Dorpat professor, Brauel. The wonderful biological work of the greatest living master in bacterial cultivation, Koch, in connection with this bacterium is entirely overlooked, and a polemic entered into against him because he had not accepted Pasteur's inoculation theories and experiments as conclusive. His great contemporaries in the study of and experimentation with preventive vaccines, those eminent French veterinarians, Chauveau, Cornevin and Toussaint, find no mention whatever. Yet it is a question if it has not been as brilliant and valuable to agriculture as the more sensational rabination of Pasteur will prove to man.

The fact that different species of animals possess a different degree of receptivity for the specific germs of the same disease, or better, the virus of a given disease, is much older than Pasteur's works on these subjects. Again, it is a mistake to attribute to Pasteur the discovery of the principle of the attenuation of such a virus by being passed through certain numbers of a given species of animals.

Renault anticipated him in asserting "that the rabaic virus of the carnivora, though potent in producing the disease in herbivora, lost this potency in them, and hence the non-virulence of their saliva."

The experiments of Prof. Rey, of Lyons, show that there is some foundation for the belief that repeated transmissions attenuate the power of the infecting element. By successive inoculations he found that rabid virus from a single primitive source appeared to act with much less promptitude on the last than in the first inoculated animal, and that in sheep its action ceased after its fifth removal or generation. These statements do not in the least detract from the character of the work done, or the reputation of Louis Pasteur. They only show the slow path by which scientific work is done. The world does not take sufficient cognizance of the work of the individual discoverers of facts—the sappers and miners of science—who have prepared the way and made possible the discovery, or better, the application of great general principles by such men as Virchow, Darwin or Pasteur.

It is a singular coincidence that the two greatest and most sensational discoveries to which the salvation of human life from accidental injuries is due have been made by Frenchmen. Some great French artist should attempt to re-mortalize the glorious painting of Ambrose Paré introducing the ligature on the field of battle, thus saving millions of lives, and other millions from the tortures of the seathing iron and scalding oil; on the opposite side of the picture he should portray another immortal, and picture some fond mother blessing that grand, quiet, self-devoted man, Louis Pasteur, for saving her child's life from a group of maddened, demoniacal dogs, that cower before the master's glance.

It has been already mentioned that to Pasteur is due the discovery of the valuable fact that the brain and spinal cord of rabid animals contained the virulent elements in a most active and thoroughly reliable form for experimentation. Having arrived at this hypothesis from the critical study of the phenomena of the disease in rabid dogs, the next thing to do was to prove its correctness by actual experiment.

The dog, itself, is the only really reliable animal upon which we can depend to test any such material. Pasteur next resolved to see what would be the effect of bringing some of this brain material from rabid dogs in direct contact with the brain of healthy ones. The result was the establishment of the actual period of infection in dogs in this disease. Numerous experiments prove that in about fifteen days rabid phenomena could be depended upon appearing. This great result is of great practical importance as a trustworthy means of diagnosis in case of suspicion of rabies in a dog, especially if human beings have been bitten.

If the dog has not been killed, a week's close and secure confinement will satisfy the question as to rabies, or not; but when it is impossible to catch and confine such a dog, and it has been killed, this method of intra-cranial inoculation can be depended upon to give satisfactory results.

The method of inoculation is simply that of ordinary trepanning, but the instrument should not have a diameter larger than the end of an ordinary lead pencil. Great care must be taken not to penetrate or injure the dura mater. In his first experiments, Pasteur used a piece of the infected brain substance simply, but subsequent experiences have shown that the material can be better depended upon when held in suspension in a fluid medium. An ordinary hypodermic syringe, with a curved needle is used to introduce the virus. A quantity equal to two divisions of the piston-rod is sufficient.

A virus is any material upon which specific infectious elements are bound: it may be fluid or solid, but is not the specific material itself, as is too frequently asserted. The animal must be chloroformed. The operation is terminated by suturing the skin in the ordinary manner. All antiseptic precautions must be rigidly observed.

The inoculation experiments were continued, and on account of their zöological connection with man, it was but natural that Pasteur should desire to test the results of such experiments upon monkeys. As previously mentioned, the fact was already well known, and had been well demonstrated in connection with some other diseases, that a specific virulent material may become ameliorated by being passed through a succession of animals of a given species; while in another species of animals the same material had been shown to have a steadily increasing force until a given limit has been reached. The number of animals necessary to produce either of these effects with a given virus has always been found to be approximately the same. In monkeys, Pasteur received the first mentioned result. He must have been, indeed, surprised to find that these creatures, so nearly related to man, should have, in contradistinction to the latter, a natural predispositional immunity against the action of the most active virus taken from mad dogs. It had some effect, but none of the terrible phenomena which characterize the disease in man, were observed. On passing this same cerebral material (originally taken from a mad dog and proved by correction experiment on other dogs) through a very short series of monkeys, it was found that it had ceased to have any visible action, which condition was also reproved on dogs. Hence the brain or spinal cord of a rabid dog will not produce characteristic rabies in monkeys, and if passed through a very small number of such animals the same substance, when taken from them, has no action whatever when re-tested upon dogs by the same procedure.

Whether such an apparently non-virulent material from monkeys will again acquire its original canine virulence on being again passed through a series of dogs has not been decided so far as one can judge from the very brief and incomplete publications of M. Pasteur in the "Comptes Rendus," nor was anything of the kind related to me while in Paris.

From his experience in the study of "Rouget," Pasteur was warranted in assuming that he had discovered in monkeys a medium by which he could provide himself with the material for a *primary preventive vaccine.* Unfortunately, monkeys are unsuitable, on account of their scarcity and consequent cost. It would be interesting to know if this constitutional indifference to rabies is shared in by the different race of monkeys, and how it varies in them.

The rabbit has been selected by experimentalists as the best suited of all animals for vicarious experimental sacrifice. In this way it has served the needs of science, and been made to contribute to our exact knowledge of biological processes in health and disease than all other members of the animal kingdom together. No man has probably made more use of this animal than Louis Pasteur, and it was but natural that he should have had recourse to them in his further researches for a preventive vaccine against rabies.

Although in that book on his life which has been so frequently alluded to, it is said that " the grand problem in regard to hydrophobia is, not so much the isolation of the microbe as the finding of a means of preventing this frightful disease." Still, every one who has worked in this field of research, or who is at all acquainted with the methods and aims of Pasteur, knows that it is to the solution of this problem, and the discovery, isolation and cultivation of this specific microbe, with the sequential production of a virus from it, that the great French master looks for the grand conclusion which can only make his work, in this direction complete, and by which alone a thoroughly practical virus can be obtained which will be adapted to universal application.

He inoculated these rabbits in the sub-meningeal space of the brain, exactly as he had his monkeys and dogs. The primary inoculations gave exactly the same results as had been obtained in dogs. The brain, or cord material taken from rabid dogs produced rabbit rabies in about fifteen days. Rabbit rabies is not, however, characterized by the furious phenomenon which is common to that disease in dogs and man ; it is a form of progressive paralysis : there is no excitement or tendency to bite, hence these animals should never be used for that purpose.

The brain substance from these primarily-inoculated rabbits when re-inoculated on dogs, produced rabies again in them in about fifteen days, thus demonstrating the constancy of the material in its active characteristics.

On proceeding with these inoculations through a series of rabbits, it was found that this material gradually augmented in virulence, until after having been passed through a series of from twenty to twenty-five rabbits in a successive manner, it demonstrated an ability to cause the characteristic phenomena of rabbit rabies in about eight days, and finally, after having been passed through another series of rabbits, a maximum of virulence was attained in such cerebral material that it caused rabies in rabbits in seven days, and when passed from rabbit to rabbit, retained this constancy of character.

It has been, as yet, impossible to find a method by which a material could be produced that would shorten the period of inoculation less than the mentioned seven days. Such a material from rabbits will cause rabies in healthy dogs when inoculated in the same manner in from eight to ten days, which sufficiently demonstrates its augmented virulence as compared with the material primarily taken from rabid dogs that required fifteen days to produce the same effect.

To recapitulate:

1. Brain material from a rabid dog inoculated into a healthy dog's brain, has a constant period of infection of about fifteen days.
2. The same material, when inoculated into any number of individual rabbits, has also a constant period of infection of about fifteen days.
3. When the material from one of these rabbits is carried through a succession of rabbits, it finally acquires a constancy of action that will cause rabies in rabbits in seven days.
4. This last material, inoculated into dog's brains, causes canine rabies in eight to ten days.

It took three years to discover and satisfactorily confirm the above facts.

In December, 1885, a child that had been bitten thirty-five days previously by a mad dog, was treated by M. Pasteur, not without objection, however. Before its removal from Paris the child died of rabies. The opponents of Pasteur were filled with joy. They asserted that "his treatment was not only futile, but dangerous; the child may have died of induced rabies, and not from the dog bite."

Pasteur was not at all disconcerted. He had an autopsy made upon the child, and taking some of its brains, inoculated several rabbits (I saw them). As the symptoms which are characteristic of this disease did not appear until the seventeenth day, and as the child had latterly been inoculated with a virus from rabbit material that had been proved to possess the seven-day virulence, Pasteur defiantly asserted "the child came too late: it died of canine rabies."

Can rabies be differentiated from pseudo-hydrophobia in man by Pasteur's method?

Yes, if fatal.

The following case illustrates this point:* "Dr. Dujardin-Beaumetz made another report to the Council of Hygiene of the Seine to the effect that a case of death from hydrophobia recently occurred at the Hôtel Dieu, and that he had reason to believe that the disease came on spontaneously, as the body bore no marks of having been bitten. The patient was, however, epileptic, and this circumstance would tend to confirm Dr. Dujardin-Beaumetz's conclusion, though the patient denied having ever been bitten. Nevertheless, experiments performed by M. Pasteur on two rabbits which he inoculated with fragments of the medulla oblongata of the patient proved that the latter died from hydrophobia."

Having thus discovered a method by which a most virulent material could be obtained in any desired quantity and be available as a "secondary," or test vaccine, it remained for Pasteur to find some method of attenuating it so as to place in his hands a very weak material which could be used as a primary, as well as material which could be graded at will to assume any intermediate conditions.

In his researches after a virus to be used against anthrax he had discovered that while the bacilli of that disease developed spores at a temperature of 37° C., that when subjected to a constant temperature of 43° C., in a thermostat, the cultivations of these bacilli no more developed spores in bouillon, and that, with each day's exposure to this temperature, the cultivations gradually lost their virulence until it almost entirely, if not wholly, disappeared, when such constant exposures had extended over fourteen days.

Another wonderful fact was also discovered, viz., a bouillon cultivation of this character always retains approximately the same degree of virulence, according to the period of exposure to this temperature. Hence, a bouillon thus treated fourteen days constituted a *primary*, or almost non-virulent vaccine; one that had been exposed ten days is more virulent, and so on to the first, or strongest bouillon virus.

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* Paris Letter to *Med. Record*, Dec. 18, 1885.

Experiments on animals have shown him, and been retested by others, that if an animal is serially treated by inoculation with this anthrax virus, beginning with the so-called primary, or fourteen-day bouillon, and after the lapse of ten days, succeeding with the stronger, that in the course of a few weeks a constitutional condition is produced in the animal—sheep especially, which renders it immune against the action of the strongest, or natural, virus.

Subsequent observations have shown that this produced immunity can be depended upon to last about a year. The next question was how to produce a similarly reliable virus from the brain substance of rabid rabbits. Had the "grand problem" of the discovery of the microbe been successful, it is very probable that the method would have been perfected much sooner, and in a far less inexpensive manner, both in money and animal life, than is possible under the present one.

PASTEUR'S METHOD FOR THE PREPARATION OF HIS ANTI-RABIES VIRUS.

The previously-considered studies upon bacillus anthracis indicated a probable method, but the cerebral, or cord material, had to be used instead of pure cultivations of a specific bacterium.

It was determined to try the effects of heat and cold upon such material, and, as is evident, the moisture in it might have some deleterious effect, a method had also to be found for abstracting the latter from the nervous substance as well as from the air in the vessels to be used.

Specimen jars, holding a pint of liquid, with hooks on the inside of the covers, are just the thing for this purpose. They must be cleanly washed and thoroughly sterilized; in the bottom of each jar must be placed enough of the driest caustic potash, in lumps, to fill the jar about one-third. The cover must be air-tight. The brain substance, not being suitable for suspension, and the spinal cord having been found to possess the same degree of activity, the medulla oblongata presenting itself as the most accessible portion of the cord, was taken for this purpose. This must be taken out with the utmost care, and with the use of the most carefully sterilized instruments. It must not come in contact with blood or extraneous matter. It is then to be fastened by one end to a previously sterilized thread, the other end of the thread to be attached to the inside of the glass cover. The procedure must be done as quickly as possible. The jars are to be then placed in a warm room where the temperature can be constantly held at 20° C. The result of the exposure to this hot dry air of these pieces of medulla has shown that allowing for the effects of a slight variation in thickness, they lose in virulency with each day's exposure. At the expiration of fourteen days they are no longer able to produce an marked effects when introduced into the sub-meningeal space of either rabbits or dogs. When the bottles containing the cords are placed in a room with a temperature just above freezing, the cords retain their virulency a long time.

Pieces of such cords, about one-fourth of an inch in length, are to be rubbed up in a sterilized conical glass with sterilized bouillon, or distilled water. About a tablespoonful of the fluid must be added, a few drops at a time. The glass rod used for the purpose must be clean, and thoroughly sterilized. The material must be prepared fresh each time, and no cord allowed to stand over to be used again. If not used at once, the glasses containing the virus must be carefully covered. It is not to be filtered.

As with anthrax virus, so with this material. Pasteur found that it had a certain constancy of virulence, according to the time of exposure, that could be depended upon within very narrow limits, *i.e.*, a cord that had been thus treated for fourteen consecutive days had little or no pathogenetic action; one that had been thus treated for twelve days had more; one of eight days still more, and so on, increasing in virulence, until the fresh, or extra-virulent cord was arrived at.

The next procedure was to test this material upon a given number of dogs by beginning with a virus made from a fourteen-day cord, and each day inoculating a material made from a cord that had been exposed to the hot dry air one day less, until a material was inoculated that would cause rabies in a rabbit in seven days, and in a dog in from eight to ten. This was done in hundreds of cases.

CAN MAN BE SAVED?

The question had no sooner suggested itself than the victim to be saved was, as it were, providentially supplied in the Alsatian boy, Joseph Meister, aged nine years, whose death Pasteur judged to be inevitable, from the nature of his wounds, and the decidedly mad character of the dog that bit him. The inoculation of this boy began on the evening of the 6th of July, 1885 (sixty hours after he had been bitten) with the injection of one-half of a hypodermic syringe full of the artificial virus, beginning with that from a cord that had been treated fourteen days.

The following summary of this boy's treatment is taken from the *Comptes Rendus*, of October, 1885:

Date.	Time of inocula- tion.	Date upon which rabbit was inoculated from which the spinal cord was taken.	No. of days the cord was dried after removal.
July 7	9 A.M.	June 23, 1885	14
" 7	6 P.M.	" 25, "	12
" 8	9 A.M.	" 27. "	11
" 8	6 P.M.	" 29, "	9
" 9	11 A.M.	July 1, "	8
" 10	11 "	" 3, "	6
" 11	11 "	" 5, "	7
" 12	11 "	" 7, "	5
" 13	11 "	" 9, "	4
" 14	11 "	" 11, "	3
" 15	11 "	" 13, "	2
" 16	11 "	" 15, "	1

At the same time the child was inoculated, a rabbit was inoculated with exactly the same material. This is done with the virus used on every person inoculated by M. Pasteur in order to keep the experiments under the most exact control. The result is thus reported by M. Pasteur:

"The medullas or cords which were removed from rabbits and inoculated on the child July 11, 12, 14, 15 and 16, respectively —that is, which had been desiccated seven, five, four, three, two and one day—all gave positive results when re-inoculated upon rabbits in a degree corresponding to the time they had been dried—*i.e.*, the freshest cords caused the appearance of rabies in the rabbits in seven and eight days, while the others gave results later and the driest gave none."

The fresh cords having therefore caused the outbreak of rabies in the regular time, which the most virulent cords from rabbits had previously done, and the same not having caused any disturbance whatever to appear in the boy Joseph Meister, Pasteur concludes "that the boy had not only escaped a future outbreak of canine rabies, but also that the systematic inoculation had so prepared the elements of his body that they were enabled to resist the action of still more virulent rabbit rabies.

In this way, Pasteur has now treated some 150 human beings, and every one of them has received, at the end of the treatment, a virus that would cause rabies in from eight to ten days.

Human beings are inoculated in the abdominal region, care being taken not to repeat the operation on the same side of the body on any consecutive days. Care is also taken not to completely empty the syringe, as the material is not filtered; an amount representing about one division line on the piston is always left in the syringe. Persons over fifteen years old receive a syringe-full; those under, about half a one; the operation is performed from ten to twelve times in the manner above depicted; no inflammatory or constitutional symptoms have ever resulted. Thirty days subsequent to the bite of a rabid dog is about the period that Pasteur considers his treatment can be depended upon.

PASTEUR'S THEORY AS TO THE ACTION OF HIS VIRUS.

In explaining his views upon this subject to a correspondent of the London *Times*, Pasteur said "that the virus acted very slowly, and, while he was making the body refractory to it by repeated inoculations, the virus deposited by the bite localized itself in the region of the wound. Wherever this region, that virus becomes digested during the year and a half which he has found, by experiment, the inoculation lasts, and will no longer exist in the body. As the propagation of the virus, which has always an ascending tendency and directs itself to the brain, takes place so slowly that the minimum of the total inoculation, with it, is thirty days, the whole question consists in inoculating the patient soon enough to prevent the propagation of the virus through the wound from spreading." Again he says,* "drying the marrows in contact with the air is an effect of impoverishment in the quantity of the virus contained in them, and not an effect of its impoverishment in virulence."

I cannot agree with any of the above conclusions.

1st.—A virus is not the *cause* of a disease. It is, as already said, a something upon which the true, essential cause is bound.

2d.—The last quotation is simply a mere playing with words. If the pieces of the spinal cord have lost in activity they have also lost in virulence. The question is not one of quantity (of the virus), but of change (in active quality) which the specific germs have suffered from the treatment the cords have been subjected to. The action of the same is upon these germs not upon the cord in which they are lodged, as such.

3d.—The hypothesis that the immunity of the individua, bitten is caused by the "digestion" of the virus (?) at the locus tromaticus, or that the inoculation acts specifically and directly, so as to prevent the propagation of the virus through the wound, and spreading, will not hold good, theoretically.

The virus in this case is the saliva of a rabid dog; the infectious elements, the unknown, yet specific microbe. A virus can never propagate; what it holds in suspension, or what it plants in the wound, can. To my mind, this prolification is very likely to occur, but to what degree I am unable to say.

The immunity must be caused by the cell-elements of the bitten organism becoming gradually accustomed to the action, or influence, of these weakened elements as introduced in the inoculated material until, like a person living in a yellow-fever region, they become so acclimatized, as it were, that these same elements when introduced in the highest activity can produce no influence upon the organism. They may, or may not be, a prolification, and generalization of the germs at and from the locus tromaticus, but their action has been negatived, they may be carried over the system, but finding no lodging-place, they pass by on the other side, as it were; they die, or undergo disintegration, and are removed by the appropriate ways.

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* "Popular Science," No. III., 1886, pp. 293, 295.

OTHER METHODS OF PREVENTION.

Cauterization.—Strong carbolic acid is the best material for this purpose when it can be had. It is more thorough and less painful than fuming nitric acid or the hot iron, and makes a wound that heals easily and quickly.

Legal Restrictions.—High license fees, and the most rigid collection of the same, with the absolute slaughter of all unlicensed dogs is one of the best preventive measures against canine rabies. A special breeder's license should be issued for bitches, to be held for that purpose only. All other bitches, no matter by whom owned, should be refused a license, and at once killed, *unless spayed*, by a person authorized by law to perform the same, and to issue a certificate therefor. These measures will lead to diminishing the number of cur-dogs to the lowest possible limit.

It is possible to make Pasteur's method of inoculation so practical that every licensed dog in the country can be inoculated. The States must supply laboratories and the means for doing it.

The following regulations should be adopted and made obligatory in each State: *

Dogs in which signs of rabies appear, or which indicate suspicious phenomena, must either be at once killed by the owner, or those having them in charge, or be placed in secure confinement until the police have decided what is to be done with them.

When a human being or an animal has been bitten by a rabid or suspected dog, or been in any relation with such, so as to render infection probable, the suspected dog is not to be killed, but must be safely secured, when such can be done without further danger, until the police decide upon the course to take.

The transport of a dog in which rabies is suspected, for the purpose of confinement, must either take place in a closed vehicle, or the dog must be securely muzzled and led by two strong chains between two conductors.

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* From the "Laws for the Suppression of Contagious Animal Diseases in Germany."

It is the duty of the local police to immediately cause the examination of a dog suspected of rabies by an official veterinarian, or when time would be lost in waiting for the attendance of the same, by an approved veterinarian. If there is a well-founded suspicion that the suspected dog has been in relation with a rabid or suspected dog, said dog must be at once securely confined and watched for a period of six days, if the examination of the veterinarian does not at once confirm the suspicion. If the dog lives over this time, and no suspicious phenomena appear, it is to be discharged.

If a dog suspected of rabies be at once killed, or if it dies during confinement, it is the duty of the police to order a *post-mortem* examination by an official veterinarian, if there has been any probability of men or animals having been bitten by said dog, or if said dog has been roaming over the country.

If the existence of the disease is confirmed, it is the duty of the police to make it known to the public in the usual way. Dogs in which rabies has been diagnosed must be at once killed. It is further the duty of the police to at once kill all dogs which have been bitten by a rabid dog, as well as all such as have been in relation with said dog, so as to render the further extension of the disease impossible.

When a rabid or suspected dog is known to be freely running over a section of country, it is the duty of the police to order the secure confinement of all other dogs in the district. All places in which the rabid or suspected dog has been seen are to be looked upon as dangerous, as well as a territory extending four kilometers beyond them. If the suspicion is unfounded, the confined dogs are to be again freed from restriction; if, on the contrary, the suspicion is confirmed, these restrictions must be extended over a period of at least three months. All dogs found running free, in opposition to said restrictions, must be at once killed by the police.

ART. VII.—PASTEUR AND HIS WORK.

The work of no other man in the realms of science, especially in the field of Preventive Medicine, has received so much criticism and so vigorous opposition as that of Pasteur. The reason for this must be sought in Pasteur himself, and not so much in his opponents. The "Life of Pasteur," which has been so frequently alluded to in the previous article, is in reality his life—the contradictions, the utter neglect of the work of others, past and contemporaneous—have been the very things most significant in Pasteur's methods, and which have called forth nearly all the opposition, and acted as a stimulus to scepticism. Pasteur is no chemist. Judging from what evidence we have at our command, he is not even a physiological chemist, nor has he any professional knowledge of the fundamental branches of medicine; and last, but most of all, we fail entirely in perceiving any evidence of a broad education in biology, zoology and philosophy which is absolutely necessary to a man's having comprehensive views in science.

After having done with his really great studies upon the beer, wine and vinegar ferments, and been of so much benefit to his country in almost saving its silk fabrication from destruction by studies of the disease of the silk worm, Pasteur next turned his attention to the study of some animal diseases. These have been anthrax, chicken cholera, hog cholera, and rabies. Pasteur did not approach either of them as a pathologist, other than that were contagious or infectious diseases, and caused great losses to France, or as in rabies, terrible sufferings to the few individuals who were unfortunate enough to be bitten by a rabid dog. Pasteur had no interest in either of these diseases. He did not care an iota about their nature other than their contagiousness, and so far as the nature of the pathological change occurring in them, they had no interest for him at all. To Pasteur they were simply a given something; that thing was nothing more or less than this: in the tissues of these animals there is lodged a specific quantity, this quantity is the contagious or infecting principle.

The next thing was what can be done with this principle? Pasteur is no bacteriologist; not one of his statements as to the existence of a specific form in a given disease are to be trusted unless we can find collateral support for them in the works of others. On the contrary, if we find such an assertion coming from his laboratory in Roux's name, we can depend upon it as if from a Koch or a Van Erningham, for Roux is a master in the technique of bacteriology, and the only micro-organism photographer in the world.

The idea of either an acquired or natural immunity from diseases of a certain character, is very, very old; hence Pasteur deserves no credit in that direction. In fact, unlike such men as Darwin or Virchow, Pasteur is not a man of ideas, not a deep thinker; he will never move the world as a great teacher, but simply as the contributor of some new evidence; how much we do not yet know, of the fact first established by Jenner, that an artificial immunity is possible, by inoculating, what has been assumed to be another disease into the human organism to prevent a specific one.

In relation to small pox, the work of Pasteur goes most conclusively to show that the above statement is absolutely false, and that in reality we do not "inoculate another disease to prevent a specific one, as is generally believed, but that in reality the vaccina of the cow is nothing more or less than bovinated voriola humana; which has accidentally acquired a certain constancy of characters in the bovine species by direct yet accidental inoculation from cow to cow, until such a constancy has been acquired as Pasteur claims he has produced in rabbits with his spinal cord inoculations.

The only varieties of variola that have the least claim to isolated individuality, are the bovine and human. Whether they were ever connected we shall never know. History will not tell. The very next question, the easiest and most practical to treat, the question as to whether a virulent material containing the active principle in a given disease, can be attenuated by being passed through a serial number of given animals, and then finally acquire a constant yet attenuated virulence, capable of acting as a vaccine—is still—small pox.

It can be done at less expense and less danger than any other, and with the promise of the most satisfactory results.

Pasteur knew, as well as all know, of this acquired immunity from vaccination, as well as that acquired from persons having been through attacks of certain specific diseases.

The most interesting question to decide is, how did Pasteur approach this question of producing immunity; assuredly as a chemist! But what kind of a chemist? Did he approach it as an analytical or sympathetical chemist? Neither!

Pasteur went at this vaccine question in the most empirical manner it is possible to think of. He had a given something to do with, to him it was a virus. Knowing of Jenner's experiences he may have reasoned with regard to the vaccina, and it is probable he did, for we find him passing anthrax material serially through all sorts of animals. It is very probable that he was led to the idea of trying the effects of an exposure to high temperature on anthrax material, from his observations on hens—where he claims to have found that their normal temperature of 42° C., was opposed to their life, or virulence, but when he cooled the hens off that they died of anthrax. The idea of serial attention in animal inocculations was long before established by Rey at Lyons, but never came to any practical application.

Pasteur utterly ignores the work of others; to my mind the reason for this is to be sought in the fact that it is largely medical, and hence knowing nothing of it, it would be of little value to him again. He does not even quote or refer to the work done by others in bacteriology.

The reason for this may be sought in two things, he does not care much whether he knows the nature of the bacteria present or not, hence that matters nothing to him.

Certainly it simplifies matters to him to be able to have them always on hand from pure cultures, but it is not generally known that neither his anthrax nor hog cholera vaccines are made from such pure, artificial cultivations, but his bouillons are secured directly from the hearts blood of animals that have been previously profusely inoculated with germs or blood from others. It is enough for Pasteur that he has this so-called virus at hand; then he goes on trying the effects of heat and cold, air and no air, one animal inocculation and another, with all sorts of contradictory results, but ever with one purpose in view, and that is to find a satisfactory method of producing out of this known or unknown something, another known or unknown something that will prove by animal experiment to give a satisfactory result.

How can we criticise such a man? They are certainly very wide from what we call scientific methods, or the manner, other men work. They are beyond all criticism, yet open to any objection. No one can follow his work, or can it be exactly contested, for we can never tell whether we are following him exactly. If you take any one of his works we shall find such a mass of contradictory statements as can be found in the writings of no other man. We have no well-arranged and systematic record of experiments giving every data, and all his conclusions are carefully reconsidered, as we find in the work of nearly every other scientific observer of this century. We find a positive assertion of results to-day contradicted by equally positive ones a week hence, but all through it we find one fact, the one point aimed after becomes more and more confirmed.

Judged by the standard we would measure other men Pasteur is not a scientist, judged by the benefits which his endeavors will confer on mankind, Louis Pasteur is one of the greatest geniuses that has ever lived. No matter what objections may be made, the result of the most sceptical testings of his work on anthrax and hog cholera by the Germans have shown that there is a valuable truth at the bottom of Pasteur's claims—that his virus will prevent it—but under conditions.

While his anti-rabies virus seems, on the face of it, to be the most untrustworthy of all, I believe on the contrary it to be the most perfected of all Louis Pasteur's apparent crude and truly empirical methods. They are the results of patient, untiring devotion to an idea; they have been in part successful, and whatever else may result, Louis Pasteur has indicated a way in which we can work, open to all, that must eventually lead to the saving of millions of dollars to the national wealth, and no one does compute its influence on the fate of humanity.

ART. VIII.—OSTEO-POROSIS.

BY H. F. JAMES, V.S., ST. LOUIS, MO.

Since Varnell's admirable account of the disease known as Osteo-Porosis, very little has been written on the subject This is a matter of surprise, as a large number of regulars have been practising for years in those sections of the Mississippi Valley where the disease appears most frequently, and with the exception of an able paper by Dr. Adam Harthill, of Louisville, Ky., read before the student association of the Ontario Veterinary College in February, 1884, I am not aware that much has been recorded concerning this malady. Young horses are most frequently attacked, but neither age nor sex affords any protection. It is presumed that the phosphate of lime of the system is discharged in the urine, but analyses have as yet been too imperfect in detail and limited in number to enable me to speak with certainty on that point. The first stage simulates rheumatism so strongly that diagnosis is not only difficult but impossible, unless we take the position held by many that we cannot have rheumatism without swelling of the affected parts.

The first suspicion of osteo-porosis is usually excited by a tucking-up of the flanks and a general look of unthriftiness, the signs of mal-assimilation being rapidly developed. A short, stiff gait is shown, perhaps a little lameness in one or more of the limbs which may shift or entirely disappear, and the disease be in abeyance for months. The idea that the bones of the head and shoulders are first affected is an erroneous one. I have seen well-marked cases in which not the slightest swelling or tenderness of these parts could be detected; but as a general thing it shows itself by a swelling of the bones of the face or a thickening of the ramus of the lower jaw sooner or later. There is rigidity of the loins, and the resemblance to a rheumatic attack is very close. But the symptoms do not yield to anti-rheumatic medication; marasmus increases, perhaps a little puffy swelling occurs in either a fore or a hind fetlock, and all of a sudden when making a hasty step, the perforans is detached from the os pedis, carrying small fragments of bone away with it, the sesamoids fracture, the suspensories tearing away small pieces of bones, or any part of the osseous system may give way from an apparently trivial cause. I have seen a horse fracture both femurs starting a heavy load, another one going only a little stiff fall in a spring wagon and fracture the bodies of four dorsal vertebrae; in these cases of course the diseased process was of some standing. A post-mortem usually shows the slate-colored appearance of certain of the articulations. A peculiar feature of osteoporosis is the rapidity with which the disease may be developed in an apparently healthy animal. The exciting cause may be a wound of any kind, most frequently a nail in the foot. The puncture is well pared out, soaked in hot water and poulticed; everything connected with the local treatment is done thoroughly and yet the patient does not bear much weight upon the limb. You again pare the part thoroughly and search for deep seated suppuration, find nothing and perhaps conclude that subacute periostitis of the pedes has set in, more hot poultices give no relief, you come in some morning and your patient standing pretty well on the foot, but now propped up by both fore legs in an exaggerated founder attitude. There is no heat of the feet, no sensitiveness to tapping with the hammer, and you quickly satisfy yourself that there is no congestion of the laminæ. The pedal bones are becoming affected, osteo-porosis has been brought on in some occult manner by the irritation of the puncture; the predisposition to the disease being already in the system. Marasmus increases, the animal is continually stretching backwards in a vain attempt to obtain relief from the excruciating agony it suffers, the appetite is poor, sometimes the poor beast will starve to death if the bones of the head are badly affected, decubitus is frequent, finally a fracture occurs, ligaments and tendons are torn away from the more diseased bones and the usual termination is reached. Implication of the pedal bones is very common where the taint is in the economy, and the exaggerated founder attitude which I have before referred to, and which is seen more often in the front limbs is very characteristic. These cases used to puzzle me somewhat when I first came west, but I soon recognized my enemy. I have seen it develop very quickly after a bad attack of acute indigestion. Situation does not seem to have much to do with its appearance. I had 18 or 20 cases not long since in a stable with a dirt floor. The drainage was poor, but I do not think that has much to do with it; the food is probably responsible. It is becoming rarer every year as the land is being better cultivated, and it is not dreaded here as it was formerly. The possible existence of osteo-porosis should always be allowed for in diagnosing apparently rheumatic troubles in horses coming from the Mississippi valley, the absence of swelling of the bones of the head is by no means to be regarded as positive evidence of freedom from the taint. Treatment is absolutely useless, neither purgatives, tonics, nor anything else will restore proper nutrition, and death from marasmus or disability from the giving way of diseased structures is the inevitable result.

ART. IX.—THE DIFFERENTIAL PATHO-ANATOMICAL DIAGNOSIS IN GLANDERS.*

BY PROFESSOR SCHUTZ,

Of the Imperial Veterinary Institute, Berlin, Germany.

The fact of the great frequency with which we find primary pulmonary glanders mentioned in the animal statistics with regard to animal pest in cases of horses that have been premptorily slaughtered by the Veterinary Police on account of real or suspected glanders, has long been a matter of general attention.

In the Fifth Annual Report of the Technical Veterinary Commission of Prussia, one may see that it is the view of the majority of the authorities, that primary pulmonary glanders occurs in one-half or even two-thirds of the cases of glanders without there being any indication of complications either in the nasal cavities or skin.

These assertions do not, however, agree with actual experience, and hence lead us to conjecture that other complications than those of glanders have frequently led to a mistaken diagnosis, and that in consequence the number of cases of unquestionable glanders must be less than those given in the statistics. Consideration must also be given to the fact that many official veterinarians, scarcely ever mention any other form than pulmonary glanders in their reports, but, at the same time, have no other grounds for their conclusions than the presence of a few isolated caseated or calcified noduli in the lungs.

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* The following article was drafted especially for the instruction of the Chief Veterinary Police officers in Germany, and is now published for the first time.

In order to bring the question of the prevalence of primary pulmonary glanders to some definite conclusion, it was ordered by the minister of agriculture that the lungs of all horses that had been killed by the authorities in which those making the autopsies considered the above complication to exist, should be sent to the Pathological Laboratory of the Veterinary School for a detailed examination. In accordance with this order there were sent to the school (from the 24th of February to the 10th of October, 1882,) the lungs of 127 horses; of these 92 were decided to have the pathological lesions of glanders, and 35 to be free from the same. The following remarks are based largely upon the results of the study of these organs.

Glanders is a disease that finds its origin in a contagious principle, which transplants itself solely in the equine, and is transmitted to other species of animals, including man, by means of accidental infection only. The specific pathological product in glanders is a small nodulus being about the size of a millet seed, which is composed largely of round cells and a more or less dense stroma or connective tissue. These noduli must be, therefore, classed among the connective or granulation tissue neoplasms. This tissue is soft and contains more or less fluid in its meshes, and is of a yellowish-white color. The more rich in cellular elements, such neoplasms are, the more clouded or pearly in color do they appear. The fresh nodulus in glanders is gray in color and consists of small round cells; the older ones are of a yellowish color and contain, at the same time, larger cellular elements. These nodular neoplasms undergo necrobiotic degeneration which frequently leads to the formation of cavities where they are situated in the midst of paranchymatous organs; when seated superficially,as in the nasal mucosæ or the skin, such degeneration leads to the formation of ulcers. When fatty metamorphosis occurs in these noduli, they are clouded yellow in color; this cloudiness has frequently led to the noduli being looked upon as (genuine) tubercles.

Attention must be called to the fact that many pulmonary diseases in the horse are characterized by the presence of circumscribed productions of the most variable character and form; it is also too frequently the case that many veterinarians designate every variety of nodulus met with in the lungs as tubercle. Hence it is that, even in the present day, we often find the noduli in glanders mistaken for genuine tubercles. The name tubercle is not only a descriptive term, *i. e.*, with reference to form alone, but has also a distinct scientific importance; it is used to designate very small noduli (tubercula) of a certain kind. Even though the products in tuberculosis bear a certain resemblance to those in glanders, still from the etiological point of view they vary essentially from one another. It must also be borne in mind that genuine tuberculosis is an exceedingly rare disease in the horse, and that the fresh tubercle is pearly and transparent, the older, opaque and whitish, while the nodulus in glanders is, when fresh, grey; but later on, yellow; and finally bears a strong resemblance to small abscesses. The nodulus in glanders resembles the tubercle, however, in that they frequently form nests or conglomerate masses, and break down, especially when superficially situated, as in a mucosa.

It is incorrect, however, to compare the ulceration of a nodulus in glanders with the bursting of an abscess. Whenever an abscess comes to development, the tissues are destroyed, in the place of which is formed a cavity filled with pus, which finally bursts, leaving a distinct interruption in the continuity of the tissues involved; the nodulus in glanders undergoes, on the contrary, a gradual process of ulcerative destruction, the material which escapes from the same being the detritus or remnants of destroyed tissues. As this softening or ulcerative degeneration does not at once complicate the entire nodulus, we find the base and circumference of the neoplasm the seat of neoplastic granulations presenting a lardaceous appearance. Such an ulcerated nodulus gradually cleans itself from its necrobiotic elements, leaving nothing but a most superficial ulceration which is frequently difficult of recognition and having the peculiar form which has given to it the name of "lenticulor ulcer."

These lenticulor ulcers have too frequently been described as erosions, an entirely erroneous expression, for the latter is nothing more or less than the circumscribed removal of the epithelial covering from underlying tissues. In lenticulor ulcerations, however, not only the epithelium, but also a portion of the tissues under it, undergo necrobiotic destruction

The development of the nodulus in glanders and the progressive process of ulcerative destruction which it undergoes can be best studied in the nasal mucosa. In a short time, there develops a new nodulus and ulcer, either in the circumferences or in the deeper seated tissues of the primary one at some distance from it; from the coalescing of such neoplasm and sequential extension of the ulcerative processes, ulcerated surfaces developed of variable extent and form, which are known as secondary ulcers. The latter are characterized by their swollen irregular edges and uneven base, and by the presence of newly developed and small noduli that have not yet undergone destruction. This nest-like development indicates that the primary nodulus, or ulceration, exerts an irritative action upon the adjoining tissues, which unites in them the development of similar disturbances, and indicates that the contagious elements of glanders proliferate in the primary noduli and penetrate into the adjoining tissues by means of the capillary circulation. It is not necessary that the secondary processes develop in the immediate vicinity of the primary; they can appear at a distance from the source. This manner of extension of the pathological processes in glanders is especially frequent in the respiratory tract, when they can extend to the inferior part of the nasal cavities or the sinuses of the head, the œsophagus, larynx, trachea, bronchial tubes, or even the lungs. The ulcerations may be either superficial or profound, according to their situation in the tissues, but scarcely any tissue is free from them. They often extend to the perichondrium in the nasal septum or the valvular covering of the eustachian tubes, or the cartilages of the larynx, trachæ and bronchial tubes, and to the periosteum and underlying osseous tissues in appropriate localities, causing necrobiosis in all such parts. It is not an unfrequent occurrence that perforation of the septum nasi results therefrom, or that cicatricial contractions and deformations occur in other parts of the respiratory tract. The processes of glanders in the mucosæ are often connected with simple inflammatory disturbances in their vicinity. The noduli and ulcers are frequently surrounded with a nucleus of injected blood vessels which renders their recognition essentially easier than it otherwise would be. In most cases, we find the adjoining mucosa in a more or less catarrhal condition, swollen and secreting an aqueous, purulent or hæmorrhagic mass. The seat and extent of the catarrhal irritation decides the quantity and nature of the secretion in horses diseased with glanders more than the ulcerative disturbances in the anterior portion of the respiratory tract. The bronchial mucosa is frequently the seat of such excessive irritation that their luminea is completely filled with a muco-purulent mass. The catarrhal processes often extend from the nasal cavities to the frontal and lateral sinuses of the head, causing them to become filled with a more or less dense secretion of a similar character. They can also extend from the pharynx through the eustachian tubes to the guttural pouches. When the irritation thus caused is very violent the secretions acquire an hæmorrhagic character. These simple inflammations, *i. e.*, such that are only secondarily due to the glanders irritant, often complicate the more profoundly situated tissues. The mucosa, especially, the submucosa of the nasal cavities, becomes intensely swollen and odematous. In the larynx, such processes frequently cause "œdema glottidis."

When the infiltrative processes have reached a certain depth in the tissues, we often find a purulent perichondeitis in the septum nasi, less often in the larynx, but especially frequent on the processes vocales. These disturbances frequently lead to necosis and perforation in the complicated parts, or to serious cicatricial retractions.

The ulceration in glands, either primary or secondary, often heal through cicatization, so that we can see hundreds of such scars in the trachea. These cicatrices have more or less stellate form, but possess no constancy in this direction however. When the ulcerative processes extend equally in all directions from a primary nodulus, the healing first begins at the centre, while the neoplastic and ulcerative disturbances extend at the peripheries. These large ulcerations can also heal; which they do by the ordinary wound-healing granulation processes; they are frequently the seat of more or less extensive hæmorrhages. This cicatrization does not, however, always occur in a harmless manner; for, as already said, all sorts of malformations upon the parts complicated may occur, even to the utter destruction of the entrance to or lumen of the diseased cavities or tubes. It is unfortunate that definite healing seldom results for the development of new noduli, and ulcers most frequently come to pass either underneath the newly developed cicatricial tissue or in its circumferences; similar processes also develop within the elements of the cicatrices themselves, giving the impression that the latter were also the object of deuteropathic invasion, hence cicatrization is not always the termination in glanders, but simply a part of the same.

The frequent recidives that occur in glanders are the cause of the chronic and indurative character frequently seen in simple inflammatory processes which are represented by superical and more profoundly seated disturbances; the mucosæ of the respiratory tract are most frequently the seat of such wart or plaque-like excrescences.

It has been already mentioned that the specific processes in glanders can extend from the nasal cavity to the adjoining sinuses; the most frequent occurrence is, however, a chronic catarrh in the latter. The mucosa, with which they are lined, secretes such immense quantities of a muco-purulent material that the cavity is either filled thereby, or can, even in very chronic cases, become gradually somewhat distended. The perivateum of living cavities often participates in the disturbances which are characterized by the development of verrucose or more less extended neoplastic productions.

The processes in the skin as well as the mucosæ are invariably accompanied by complications of the lymphatic system. The latter one of a secondary nature, and bear direct connection with those parts from which the glands receive their lymph. The contagious principle is taken up by the lymphatics in and around the primary diseased localities and by them, conveyed to the first lymph glands in their course, and from these the irritans is still further conveyed over the system. When the disturbances in the septum nasi are limited to one side, we find that the submaxillary, pharyngeal and other lymphatics upon that side only become diseased; the same is true with regard to glander complications beginning on one or the other extremities. The diseased glands become hypertrophied, and upon section present a more or less refracting surface of a reddish or greyish color. Later on, they become dryer and the cut surface appears less smooth; in the latter we observe small white spots or striæ, which correspond to the swollen follicles or the thickened inter-follicular tissue. When the irritation is very severe (acute glanders) we often find the glands the seat of more or less extensive hæmorrhages.

This is the first or simple hyperplastic stage. Following on this the glands become more dense and the cut surface is of a greyish-white, reddish-grey, or red-white color. The gland appears to be made up of cellular (medullary) tissue, its cut surface being somewhat like velvet, on account of the projection of the swollen follicles.

This stage is known as that of "medullary hyperplasia." In neither of these stages, which of themselves have nothing characteristic of glanders, does the cellular hyperplasia attain the degree of development which frequently occurs under other irritative conditions in the nasal mucosa, which are bound with complications of the neighboring lymph glands. These glands in glanders seldom acquire a size beyond that of a walnut. It is also to be remarked that the individual nodes of the glands become somewhat flattened by mutual pressure, but do not become adherent to one another; at this period, the capsule of the gland is generally unchanged also and the skin covering the gland still unattacked. In the living animal, one can frequently notice that the glands are somewhat painful on pressure.

If the glanders processes in the skin and nose heal, the supply of irritating material is thus shut off from the lymphatics and the glands become smaller again, though not assuming their original size. In general, however, this does not occur, for, as already said, in most cases this disease is characterized by the gradual extension of its disturbance though healing in the primary affected parts is frequent. It is also well known that the enlarged condition of the glands can go on increasing through the development of neoplastic elements in the interstitial tissue, or stroma of the same by which they become intensely hard and undurated; these processes extend to the capsule and periadenoid tissue frequently causing their attachment to the overlying skin, or adjoining parts.

Among the specific occurrences in the glands must be mentioned the development of noduli; the earliest changes which are capable of macroscopical demonstration are small circumscribed points of a greyish or greyish yellow color; they may be either disseminated over the substance of the gland or accumulated in nests, and be found either in the medullary or cortical substance of the gland. No matter how much of the gland may be assumed by these specific disturbances, we shall always find the other parts in a condition of cellular hyperplasia of a simple irritative character. The yellow spots become larger and larger, and either undergo purulent degeneration, or become clouded, desiccated (Necrobiosis) and form caseous conglomerates or noduli. Such abscesses, or conglomerates may be frequently found in the midst of a hypertrophied gland. The specific irritant having gained access to the gland, exerts continuous action which leads to the development of chronic, indurative conditions.

As in all other specific diseases, so in glanders, we must divide the pathological disturbances into the primary, or specific, and secondary, or simple inflammatory processes. They are active processes, the one class may be compared to those which may follow any form of irritation; the other, on the contrary, possess peculiarities which are specific to glanders. When lymph glands are in a hyperplastic or indurated condition, we must not assume that they, of themselves, offer anything peculiar to our consideration; the cause, is the specific agent, which interests us; for by the latter alone can we decide whether the case before us is glanders or not. The specific affection speaks to us by its own peculiarities.

In glanders it is seldom that we find the entire gland complicated by processes peculiar to that disease; as a rule single parts or lobuli of the glands are more affected than others. Suppurative processes in or around the lymph-glands that finally escape outwardly are very rare in glanders. It must be remembered that simple suppurative inflammatory processes can, on healing, leave the glands in a condition strongly resembling those we have become acquainted with in glanders. The contents of such abscesses can desiccate and become cheesy, or peri-œdnoid indurations may occur by which the glands become hard, and more less attached to surroundings.

When, however, we observe, in specific disease of the lymph-glands in glanders that other centres of disease occur, and that large sections of the glands become diseased, and that a viscid purulent mass forms the contents of the swollen lymph-glands and that the cells early undergo disintegration, forming thereby a fatty detritus, the cavities being filled with a mush-like mass of fat-granules; that the noduli do not undergo complete caseation, but remain a sort of soft yellowish centre; we have before us certain valuable points for the differential diagnosis. If there still remains some doubts about the correctness of our conclusions, they may all be removed by giving special attention to the conditions at the primary seats of disease. We frequently find a mild form of fatty-metamorphosis in lymph-glands that are in a condition of simple hypertrophy. A cross section of the same appears, broken by whitish yellow points or striæ, while the remaining parts of the gland are in a grey hyperplastic condition. In this form of retrograde metamorphosis, the hyperplastic part of the lymph-glands is composed of fatty detritus also. If the glands have already suffered certain changes, being grey or blackish in color and indurated as well, which is often the case in the bronchial glands, the cross section then presents a peculiar variegated appearance.

We often find in lymph-glands, more especially in those in the vicinity of the bronchials, than in the submaxillaries, calcarious noduli of variable dimensions and shape, that are generally surrounded by a firm capsule. These masses can easily be removed from the latter, leaving their cavity, or surroundings, distinctly visible. A cross section of these noduli present a lamellated structure. Although it is not always possible to give a decision as to the primary nature of these noduli, especially as to whether they are of entozoöic origin, still many veterinary observers have ascribed to them an etiological connection with glanders without sufficient reason. It is not explainable why the noduli of glanders should become calcified in this isolated manner. It is highly probable, on the other hand, that noduli that are not so easily removed, and that have not a striated structure, are connected with glanders. But a calcification of the noduli in glanders has not been, by any means, proven in these organs, the objects must, at present, be looked upon as of an etiologically doubtful origin. Large calcified masses, occupying distinct sections of a gland, must be considered as a metamorphosis, occurring in retained purulent material. We have seen that the glanders noduli undergo dissolution in course of time, and are transformed into a mass of detritus, capable of being absorbed; this does not disturb the contagious principle in this disease, however. This mass is taken up by the circulation as well as the lymphatics; in the former case they cause direct polution (infection) of the blood —glanders dyscrasis—, the latter has been partially proven experimentally by the injection of the blood from horses with glanders into healthy ones; the same fact is also proven by the appearance of metastatic processes in distant parts of the organism of the same animal. The lungs are, in general, the seat of such metastatic, or secondary processes in glanders. It is, therefore, evident that the necroscopist must distinguish sharply between primary and secondary processes in this disease. The skin and superior parts of the respiratory tracts are most frequently the seats of these protophatic processes. In the latter, it is generally the lower section of the nasal cavity, the edges of the sublimated bones, the nasal canals, and their posterior openings, and the larynx, where the glanders processes first develop. It has been assumed that the contagious principle in glanders gains access to the lungs by means of the inspired air; *i. e.*, that the lungs can be the seat of primary processes; an hypothesis which finds its support in many reports from official veterinarians. It is incorrect to assume that this is a general or frequent occurrence, for in all the cases upon which this report is based, it was not possible to find one that gave support to the theory of primary pulmonary glanders. One either found distinct disturbances in other organs,such as the above-mentioned, that accompanied the lungs, or they were mentioned in the reports from the official veterinarians. Secondary pulmonary glanders is, however, a very common occurrence. It is self-evident that when a glanders-dyscrasis occurs, secondary pulmonary processes must develop in other organs, such as the kidneys, liver, heart, muscles, bones, etc. Such a dyscrasis is not a permanent condition by any means, as when the infectious elements gain access to the blood they must soon be again removed by natural processes, from the fact that they find a resting place in certain tissues or organs, where they develop metastatic centers, or pass away with the secretions —urine, etc. This latter was proven by numerous experiments. If the disease continues in certain parts it is self-evident that this tendency to metastatic processes must also continue. It is a very common occurrence that the processes in the anterior respiratory passages and skin heal, that the lymph glands undergo a retrograde metamorphosis and retract, and that the secondary metastatic disturbances only come to recognition after the lapse of no inconsiderable time. This period is often spoken of as "latent glanders," that is, the disease is present in invisible organs—pulmonary glanders. If horses should be killed at this time, we do not find any striking pathological changes, except those in the lungs; it is frequently the case that slight changes in the anterior respiratory organs heal without leaving easily recognizable cicatrices, and the tumefactions in the lymph glands also disappear quite as often, especially when the inflammatory processes are of a non-specific character. Such cases have led to the mistaken assumption of the existence of primary pulmonary glanders. It is also well known that this latent, or hidden, form of glanders often gives rise to secondary infection and the development of new local centers and of suspicious phenomena, which render the disease again open to ocular demonstration. It is possible that such cases have led to the assumption of the spontaneous origin of glanders.

The specific glanders noduli in the lungs always appear in numbers, never as single phenomena; they are somewhat more than miliary in size, and are at first gray and moist, but later become yellow and dry in character. They either lie sub-pleural, so that they can be seen through the same, or in the substance of the lungs; they develop in the stroma, or connective tissue of these organs which separates the lobuli one from another. The fresh noduli are surrounded by an irregular zone of inflamed paranchymatous tissue, the circumferences of which are not sharply defined. These zones are hyperæmic, moist, atalectatic, and present a smooth surface or section, though they are sometimes granulated—fibrinous pneumonia. We may frequently see the nodules differentiated quite sharply from these pneumonic surroundings by a red ring of tissue. We find here the usual combinations of specific (glanders) and simple inflammatory processes, and in passing the fingers over the pleura of such a lung we not only feel the noduli specific to glanders, but also the pneumonic centres surrounding them. The number of these noduli is very variable; in some lungs they are present in thousands, sometimes disseminated, sometimes in nests, or conglomerates, so thick together that the infiltrated pneumonic centers coalesce, so that large sections of the lungs are tranformed into a dense and atalectetic mass. The noduli and their surroundings soon undergo certain changes. The gray noduli become opaque and yellow, or yellowish-white, surrounded by a transparent gray, and vascular tissue, which can be traced to its connections with the interlobular tissue and the septa of the alveoli. These yellow centers are slightly caseous, but do not present a thoroughly desiccated appearance; their circumferences are not regular, but are interrupted by the extension of processes of a like character with the fibrous surroundings, so that we cannot remove these noduli, even with the aid of the point of a knife, without tearing the tissues in which they are situated. When confluence of numerous noduli has taken place, we find that large sections of the lungs have been transformed into a dense mass of gray or grayish-white indurated tissue which encloses the necrobiotic noduli in its midst; upon sections of the same the latter appear as small yellow centers surrounded by a sort of capsule, or as conglomerates of the same color, with irregularly-marked outlines. At other times these centers are of a purulent character, surrounded by infiltrated pulmonary tissue, which is often complicated by softening disturbances that began in the specific products of glanders, giving rise to the formation of cavities of variable size and form, that are filled with a purulent or mush-like mass. New eruptions may be seen in the vicinity of these centers which are of essential value in recognizing the specific nature of the disturbance. At other times we find the disintegrated mass surrounded by a pale gray layer of fibrous tissue which forms a sort of capsule; the cross section of such spots reveals the existence of cavities and canals, filled with purulent and necrotic material. The ulcerative disturbances frequently lead to the erosion of blood-vessels and sequential hæmorrhages; the latter are, however, often prevented by the formation of thrombi in the vessels—a very common occurrence in the lungs in glanders. Small embolic centers may be mistaken for freshly-developed glanders noduli; they vary in size from milliary to that of a pea, and are filled with a yellowish or clouded mass, surrounded by a hyperæmic umbus of a dark red color, and having a smooth surface on section. The hyperæmic tissue surrounding the noduli in glanders is never black-red, and not so wide in extent, and does not contain so much fluid blood as the hæmorrhagic. Acute broncho-pneumonia centers may be also mistaken for those peculiar to glanders; the same are small isolated complications, or they may be seen in groups, and are of a red or reddish-gray color, projecting somewhat above the cut surface of the lung; the bronchial tube presents itself as a small, yellowish point in the midst of pneumonic infiltration; if one pour water gently upon such points we can easily demonstrate the presence of the bronchial tubes which will appear a small round hole, out of which has been washed the mass with which it was filled. It has frequently happened that centers of ordinary pneumonia that have undergone a form of gangrenous dissolution have been mistaken for those of glanders. Pneumonia in the horse often occurs in a multiple form, *i.e.*, in numerous inflammatory centers distributed over the substance of the lungs; they are at first hyperæmic and glancing, but later on becomes dry (anæmic) and yellowish or yellowish-white in color. Necrobiosis of the pulmonary tissue frequently occurs which leads to the development of a sort of sequestor, or of a mass of broken-down tissue enclosed in a sort of capsule, which marks the line of demarcation from still healthy tissue. It is in this way that the so-called abscesses in the lungs are formed. Fresh ones are immediately surrounded by intact or infiltrated lung tissue, while older ones are enclosed by indurated tissue, making a sort of capsule. The bronchial lymph glands are at the same time in a condition of cellular or fibrous hyperplasia. The fresher these conditions, the more easily can they be distinguished from others, because we cannot find the gray or yellowish noduli of glanders in the diseased portion of the lungs at such times. The differential diagnosis is, however, possible later on, because it is very seldom in glanders that we find either single or several infiltrated lobuli separated, as it were, by these gangrenous processes in the direction of the interlobular striæ of connective tissue, while such is the rule in pneumonia. Further, the necrotic tissues in pneumonia, which were previously very full of blood, do not give up their color, as in glanders, but retain a very marked yellowish-red color. Finally, one must always have recourse to a critical study of the conditions in other organs.

The frequent presence of calcified noduli of a size corresponding to those of glanders, have often led to mistaken conclusions. They are generally round, with sharply-defined limits, and enclosed in a very delicate, transparent capsule of connective tissue, from which they can easily be removed. The inner surface of this capsule is perfectly smooth. It has never been possible to find any adhesions between these objects and the bronchial tubes; cross sections of these calcified noduli shows a striated structure, they are often distributed over the lungs in great numbers, as well as in the bronchial glands, but less frequently in the sub-maxillaries; they seem to have a special predilection for the liver. *These things have no connection with glanders.*

Bronchitic, peribronchitic, and bronchostatic noduli have been frequently mistaken for those of glanders of an old date. It is natural that this error should have been made when we remember the extension which the idea of primary pulmonary glanders has attained among veterinarians.

These bronchial noduli are the product of chronic inflammatory processes in the parieties of the bronchials; they appear in certain forms; some develop into the lumen of the tube causing obstruction—bronchitis proliferous—in other cases aside from the thickening of the walls of the tube, we find the secretion of a purulent fluid, causing distension of the tube—(bronchitis chronica catarrhalis). When the irritation processes extend to the tissues surrounding the tubes, we have a peribronchitis leading to the development of connective tissue and apparent thickening of the walls of the air tubes. The purulent mass in the tubes frequently accumulates and becomes caseous—bronchitis caseous—causing complete obstruction; at other times, this mass calcifies and we find the lime-like material enclosed by the bronchial wall. These irritative processes generally occur in and around bronchial tubes of the smallest calibre; they may be quite extensive, or more or less sharply circumscribed; in the latter case, the tubes look as if possessed by small noduli along their extent—bronchitis and peri-bronchitis nodosa. This circumscribed or nodular form has been the cause of many mistaken conceptions and assertions on the part of veterinary authors.

They present themselves as small round bodies, of the size and form of millet seed; they are often numerous, but at other times are but sparsely distributed over the lungs. In the case of bronchitis proliferons, these noduli have a gray color, the lumen of the tube can often be distinguished upon making a cross section of the nodules. In bronchitis catarrhalis and caseosa we find the center of the nodules filled with a purulent or caseous material surrounded by pearly-gray tissue, which corresponds to the cheded walls of the bronchial tube, so that we see that what was apparently a nodulus, is in reality nothing but the cross-section of an indurated bronchial tube. When the caseous material with which the bronchials are filled at such a point has become calcified, we find a small kernel of lime making up the center of such a nodulus; the same may be round or elongated in form, according to its extent, and is easily removed.

Bronchostasis is a gradual and progressive process by which the lumen of the tube becomes greater, and in the horses comes most frequently in the smaller tubes of the anterior and lower, or central lobes of the lungs; they generally occur in multiple form, seldom isolated. According to the thickness of the wall of the tube, we speak of them atrophy and hypertrophy, and according to form, as cylindrical, sacculated, serpentine, etc. In every case of bronchostasis we find bronchitis in one form or another. Outside of them pneumonia processes frequently come to development. The circumscribed, or sacculated form often appears as noduli, being about the size of a pea, but cross section soon reveals their true nature.

It should be absolutely impossible to mistake any of the conditions for the specific ones of glanders, though one or all of them may appear in the same lung at the same time with those of glanders, or at times when there is no evidence of the latter. In fact, they are not uncommon in old horses in all varieties and degrees of development.

In all glanders noduli the purulent or caseous mass in the center is always in immediate relation with pulmonary tissue; in these bronchial conditions never; the bronchial wall invariably being demonstrable as a demarcating tissue. In the latter, the contents can always be removed, leaving the wall intact, in glanders never.

Again, of differential diagnostic value is the fact that the noduli in glanders are seldom of the same age; besides old and anæmic, we find fresh ones that are easily recognizable. Again, as a rule, the noduli in glanders are of metastatic origin, and in doubtful cases, the exact examination of the other portions of the respiratory tract, as well as body, will certainly lead to a safe conclusion.

Finally, we have to mention those chronic inflammatory or indurative processes in the lungs which generally find their origin in a chronic pleuritis or bronchitis, or begin directly in the peri-alveolar tissue. Such processes frequently lead to the development of circumscribed centers of a more or less nodular character, but very variable in size, being sometimes as large as a hen's egg; they may be frequently found in close proximity to one another, or they may coalesce, and form large irregular, circumscribed and indurated masses in the lungs; they are especially frequent in the anterior and middle lobes; such indurated spots give manifest resistance to the knife on cross section, being very dense and hard, and present a white or gray color. If such changes are in the vicinity of the pleura, the latter is also thickened, white and non-transparent; adhesions between the pleuræ are then frequent. Sometimes these nodes have but little retractive tissue in them when they present a refulgent and transparent appearance on section. Obstruction of the lumen generally follows chronic processes upon, in, or around the bronchial tubes; the same leads to atalectatic conditions of the parts supplied with air by the obstructed bronchials. In anæmic animals, such sections of the lungs are quite pale in color. If the atalectatis is of considerable duration we find that atrophy of the pulmonary tissue results. These changes occur principally in the anterior lobes, and in the lower and middle portions of the lungs.

When these atalectatic or atrophied portions of lungs become the seat of chronic pneumonic processes we find that they remain small, soft and singularly anæmic. It is self-evident that both conditions can be present at the same time. When it was mentioned that, as a rule, bronchostasi occurred in the smaller bronchi, it was meant that they did not occur on the larger, for it is well known that the latter are subject to a great variety of malforming changes.

It is not an uncommon occurrence to find that ulcerative (destructive) processes have originated in the distended portion of the tube, and finally caused perforation of the wall and pneumonic disturbances of both an ulcerative and indurative character. As the progress of the same can be traced, there is no need of mistaking them for glanders disturbances as has been frequently done.

Of the thirty-five lungs in which glanders did not exist, six were complicated with chronic pneumonia, nine with simple bronchostasis and four with the latter and connective pneumonia. In the other ninety-two lungs, aside from the specific phenomena of glanders, chronic pneumonia existed in five cases, simple bronchostasis five times, and complicated with chronic pneumonia thirteen times.

It is therefore plain that we have to distinguish quite sharply between the specific productions in the lungs that are peculiar to glanders, and due to its specific cause, and those secondary complications which, while frequently due to the action of the same cause, may either antidate the development of the specific products, or even occur entirely without their ever happening.

It was a mistake to have classed indurative conditions in the lungs among the specific and direct products of glanders, and from this has proceeded the doctrine of primary pulmonary glanders. This name is entirely misleading for these conditions, as they are not primarily connected with the etiological moment in glanders.

It has been our endeavor to draw the attention of official veterinarians to the necessity of distinguishing sharply between what is primarily and solely due to glanders, and what follows is secondary disturbances; also to the necessity of paying the strictest attention to all parts of the organism when considering the lungs or any internal parts.

ART. X.—VENEREAL DISEASE IN THE LOWER ANIMALS.*

BY PROF. THOMAS WALLEY, PRINCIPAL OF THE ROYAL (DICK) VETERINARY COLLEGE.

(Read before the Scottish Metropolitan Veterinary Medical Society).

In bringing before your notice the subject of "Venereal Disease in the Lower Animals," I may state at once that I have several objects in view. The first of these is to inquire as to what extent our domestic animals are liable to such affections. The second is as to whether we are justified, in the present state of our knowledge, in assuming that they suffer from conditions allied to those which are characteristic of syphilis in man. The third is to direct attention to a method of treating intractable venereal sores in the dog which is both sure and effectual.

In reference to the first of these questions, I may remind you that veterinary practitioners in this country are well acquainted with the fact that several of our domestic animals are sometimes affected with the disease known as *gonorrhœa* or, as it is termed in cows, "bull-burnt."

This specific form of urethritis, for such it is, occasionally makes its appearance in herds under such circumstances as to warrant the expression of an assumption that it is in such cases generated autogenetically.

I have myself seen it appear in herds in which neither the male nor the female members had ever been allowed to come in contact with other animals for procreative purposes, and I am well aware that other practitioners have seen it arise under identical conditions. In the matter of the dog, I have frequently had cases brought to me in which the owners of the animals have declared that they (the dogs) have never been in contact with any female for copulative or other purposes. When once the disease arises in the male its spread is not difficult to explain, and I have notes of some cases in a number of mares which came under the observation of one of my late pupils, Mr. Barclay, of Dunfermline, and which were all traceable to infection from one stallion, who, it was subsequently shown, was the subject of the malady.

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* Reprinted from the *Veterinarian*, January, 1886.

In France there exists a well-known form of venereal disease known as "La maladie du coit." Happily—at least, so far as I know—the equine species in this country is exempted therefrom. Neither have I ever seen any such form of disease in the sheep or in the pig.

As to how far gonorrhœa may be looked upon as a specific disease, I may first direct your attention to the fact that the literal meaning of the word used to designate this class of affection is totally out of accord with its proper application. It signifies an excessive flow of semen—a condition sometimes observed in young vigorous dogs when excited by the near proximity of œstral bitches, and which, owing to the fact that it is accompanied by tumefaction of the sheath and swelling of the testes, is confounded with the affection usually termed gonorrhœa. The use of the term is, however, warranted by custom, and I do not feel disposed to cavil at its application to the form of disease under consideration.

As to the specificity of gonorrhœa, I may remind you that the researches of those engaged in inquiries as to the nature of the disease in the human subject have not resulted in any definite issue. True, the statement has been made that a micrococcus has been detected in the discharges of gonorrheal urethritis, and in those of gonorrheal ophthalmia, identical in its characters from both sources; but there are those who assert that in urine which has undergone fermentative changes a micrococcus, recognized as *M. urinæ*, is always present; further, inquirers—MM. Lepine and G. Roux—have recently drawn attention to the fact that when cultivations of this now well-known micrococcus are introduced into the urethral canal of male animals, and retained there for a short time, a specific urethritis is established, which extends to the bladder and kidneys, and produces death, with reproduction in large numbers of the micrococcus in the urinary products; and of still greater importance is the further statement that healthy females confined in cages with these experimentally-infected animals become the subjects of identical conditions, and die with similar urethral, cystic, and renal lesions well developed.

Now, if these altered micrococci were the actual cause of gonorrhœa, we should expect that, in old-standing cases, the bladder and kidneys would become diseased; such, however, is never observed—at least in my experience. That specific urethritis in animals is identical with that of man is proved by the fact that in dogs we not infrequently see well-marked gonorrheal conjunctivitis produced by contact of the urethral discharge with the conjunctivæ. The infection is conveyed by the animal licking its penis, and subsequently one of the hind feet, from which the virus is passed to the conjunctiva in the act of scratching. Mr. Alex. Gray informs me that some years ago he saw a monkey—which had contracted the disease from handling contaminated lint thrown away by a sailor on board ship—with gonorrheal conjunctivitis, the infection having been conveyed to the membrane by the creature's own hand.

So far, then, we see that gonorrhœa affects the horse, the ox, the dog and the monkey; that in these animals its course is similar to that which it follows in man. But what about our second query: "Do the domestic animals suffer from syphilis?"

The great characteristics of syphilis are—firstly, that it is a disease running a chronic course; secondly, that its most prominent lesions are indolent ulceration of mucous membranes and skin, with chronic enlargement and induration of lymphatic glands, and ulceration of the skin covering these glands.

Do we meet with such lesions in veterinary practice? Most certainly yes—in the dog, at least. Are they of a syphilitic nature and origin? I will answer this question by expressing the opinion that they are of that nature, and I think I am warranted in so doing by the characters presented by these lesions and by their course.

I am quite aware that objection may be taken to my conclusions on the ground that the chronic lesions seen in animals are only results—or *secondary symptoms*, if you like—of gonorrhœa. So used pathologists to consider the lesions of syphilis in man, but they have now come to look upon them as being totally different, both in nature and in cause.

I know it has been said that the *chancre* of the dog differs materially from that seen in man, in the fact that its edges and base are less indurated. Granted this to be the case, may not, I ask, any slight difference in character be due to differences in structure (histologically) in the membranes in the two animals?

A chancre makes its appearance on the penis of the dog; it gradually extends its bounds; other chancres form, and in some instances the primary and secondary sores coalesce; from the surface of these sores a puriform fluid, ichorous and infective in its character, is discharged; this fluid sets up a degenerative inflammation in the skin of the thighs, the abdomen, the chin, and in fact in all parts with which it comes in contact. These sores do not yield to the local application of caustics, and in many cases are affected only to a limited extent by the internal administration of potassic iodide and mercury, unless, indeed, these drugs are pushed to a dangerous extent.

In the course of time the dog begins to arch his back, and the motion of the hind legs becomes stiff and the gait straddling. By these signs the attention of the practitioner is directed to the inside of the thigh, and he there detects a *bubo* identical in its character with that seen in man, and, like it, ultimately associated with chronic ulceration of the skin covering it. If these lesions are not syphilitic, what are they? I leave those who deny that the disease exists in the lower animals to answer the question.

In reference to the treatment of those important lesions *bubo* and *chancre*, I may observe that the former is much more easily dealt with than the latter. In my experience, the free inunction of iodine ointment, with the application of nitrate of silver to ulcerated surfaces when such are present, quickly produces resolution, but in obstinate cases I should advise iodine irrigation or extirpation of the tumor; no harm could result from the adoption of the latter course, and seeing that there is great danger of the gland becoming a centre of infection to the system, it would be the wisest course to adopt.

In the treatment of chancrous ulceration of the penis we have an infallible remedy, if I be permitted to so designate it, in castration. I am perfectly well aware that some of my scientific friends will utter an exclamation of surprise and horror when this statement meets their eyes, but one fact is worth a dozen theories, and however unscientific and unsurgical the operation may at first sight appear, it is all the same an absolutely effectual and perfectly safe cure. In the case of valuable stud dogs the removal of the testicles would, I need scarcely say, be a matter of grave importance, as its adoption would mean annihilation of the procreative function; but in dealing with animals in which their use for stud purposes is only of secondary importance, the operation should unhesitatingly be performed if other remedies fail in affecting a cure. The first occasion on which I adopted the treatment in practice was in October, 1873, at which time I had under my care a terrier of nondescript breed (much prized as a companion by his owner) suffering from venereal sores on the penis and on the skin of the abdomen and thighs. After giving the usual constitutional remedies, as potassic iodide and mercury, and the usual local applications, as nitrate of silver and sulphate of copper, a lengthened trial, I determined upon trying the effects of castration. My reason for performing the operation was that I observed whenever I manipulated the animal chordee became very marked, and this was followed by extreme vascularity of the penis and particularly of the tissues involved in the ulcerative process. In my own mind I came to the conclusion that if priapism were prevented this periodical hyperæmia would be done away with and rest insured to the cells of the diseased parts.

The operation was performed, the effects of it surpassed my most sanguine expectations, and the dog was quickly discharged cured.

In the early part of the present year I was asked to examine a retriever dog, in whom an obstinate eruption was presented on the skin covering the chin and around the eyes. I was informed that the animal had been under the care of another practitioner for some time, but that the treatment adopted had been unsuccessful. As my attention was only directed to this eruption, I did not think of looking further for the probable cause, though I was particularly struck by the peculiar character of the sores, and unhesitatingly gave the opinion that they were of a specific nature. By the application of napthol ointment, an agent, I may observe, of great value in some forms of skin disease, and the administration of mercury, the sores rapidly improved, and in fact were nearly healed, but several weeks subsequently the owner of the dog noticing an eruption of the skin of the abdomen, again brought the dog to me for examination. One glance at this eruption satisfied me as to its source and explained the origin of the sores around the eyes and on the chin; and, on extruding the penis, my suspicions were confirmed, the organ presenting on its external surface several well-marked venereal sores. These sores were treated, successively, with all the known topical remedies, not even excluding iodoform; and simultaneously, constitutional treatment was employed, but all to no purpose, and in the end the penis presented a most loathsome and horrible appearance. With the consent of the owner, castration was performed. The good effects of the operation was as satisfactory as in the first case.

I may remark that I have been informed, within the last few days, by one of my pupils, Mr. Carruthers, of Wigton, Cumberland, that during the past summer an equally successful result was obtained by the adoption of this method of treatment in the case of a collie which had been the subject of venereal sores for a considerable period.

I have often felt that this treatment, heroic though it be, might be had recourse to with benefit in the human subject. I know that sentiment would oppose itself to the suggestion, but I would ask is it not better that a man who has been unfortunate enough to contract this loathsome disease should be deprived of the means of infecting others, and be himself restored to at least a moderate degree of capacity for enjoyment of the pleasures of life than that he should be allowed to drag out a miserable existence and remain a probable means of disseminating his infirmity?

ART. XI.—TYPHOID FEVER IN ANIMALS.*

BY J. BLAND SUTTON, M. D.

The question as to the existence of typhoid fever in animals other than man is of some interest, and it is one concerning which we know very little. Dr. Budd, among some of the papers he wrote in connection with the subject of comparative pathology, put forward the opinion that the "acute infective fever" of the pig known as "swine fever, pig typhoid, purples, or red soldier," was really the same disease which we recognize as typhoid fever in man.

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* From the transactions Pathological Society of London.

The symptoms, etiology, and morbid anatomy of this disease of the pig are carefully and ably set forth in a very interesting paper in the *Veterinarian* for 1875, by Professor Wortley Axe, who also tries to prove the identity of pig and human typhoid fever.

Dr. Klein in the *Path. Soc. Trans.*, vol. xxviii, details an account of the morbid anatomy of the disease as seen in the pig, and shows, most conclusively, that the disease in this animal is totally different from that seen in man. One of the chief points in the argument is, that in the pig the ulcerated patches in the bowel, or the nodules, have nothing whatever to do with lymphatic follicles, whereas in man it is these structures which are affected.

It should be mentioned that some observers hold the view that the so-called pig typhoid is anthrax, but Dr. Klein's experiments clearly negative this opinion. Seeing then that swine fever and human typhoid are not identical, the question becomes still more pressing. Do animals suffer from typhoid? The following cases have some bearing on this matter. In 1882, while making a *post-mortem* examination on a lemur which had died in the Zoological Gardens, from perforation of the ileum near the cæcum, the Peyer's patches were found to be ulcerated in the same manner, and presented the typical appearance as these structures do under the same condition in man. No other organs presented lesions of note. For some days before death, the lemur had suffered from profuse diarrhœa, the keeper experiencing considerable difficulty in keeping the cage clean. I was so positive that the ulcerations were typhoid that the deaths of other monkeys were predicted. In company with the late Mr. W. A. Forbes, who was at that time Prosector to the Zoological Society, an attempt was made to take clinical observations; this was impossible, and respect for the integrity of our skins made us relinquish the endeavor.

Seven days after, the lemur which lived with the first patient died, having suffered for many days with diarrhœa and bloody stools. Death was occasioned by very profuse hæmorrhage. At the *post-mortem* examination, the Peyerian patches were found ulcerated from the commencement of the ileum, throughout the whole of the large intestine to the point where the ridge of adenoid tissue marks the line of fusion of rectum and anus, (hind-gut and the proctodæum of embryology). I have since found that this part of the rectum is liable to become ulcerated in man in severe cases of typhoid fever. About the same time, two monkeys died with exactly similar lesions, but confined to the ileum, also a tiger. On making sections of the Peyer's patches in the case of the tiger, and comparing them with sections taken from the human subject at about corresponding dates of the disease, the details coincided in a very marked manner.

At the time these cases occurred at the Zoological Gardens, typhoid fever was raging in the neighboring district and Camden Town.

With regard to the distribution of the lesions in the lemurs, some further facts are necessary. The ulcers extended from the ileum throughout the whole length of the large intestine, and were as large in the colon as in the ileum. This was a rather puzzling circumstance, for it had long been believed by comparative anatomists that the solitary glands were scattered in an irregular manner throughout the alimentary canal, from duodenum to rectum, whilst the agminate glands of Peyer were confined to the small intestine, being most numerous in the lower part of the ileum.

Such is not the case, for Mr. F. E. Beddard in a paper on "Hapalemur griseus," * one of the Lemuroids, records the existence of Peyer's patches in the cæcum, and in the colon to near its termination. In this mammal, the small intestine measured two feet, four inches in length and the large intestine one foot. The cæcum contained two agminate patches and the colon ten, in addition to the ordinary agminate glands in the small intestine.

In the July number of the *Journal of Anatomy and Physiology* vol. xviii, 1884, Dr. Dobson records the existence of Peyer's patches (agminate glands), in the cæcum and colon of certain insectivorous mammals and rodents. In some Insectivora, such as Chrysochlriodæ and Talpidæ, the agminate glands were found to occur at intervals throughout the whole intestinal tract from the duodenum to the rectum.

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* *Proc. Zoo. Soc.*, part iii, 1884.

Mr. Beddard has found, since the date of publication of the paper on Hapalemur, that a similar distribution of Peyer's patches is common among the Lemuroids, he having observed them in the large intestine of lemur catta, galago, and the slow loris. These interesting observations settle the question of peculiarity relative to the distribution of the lesions.

After diligent search I came across some observations, similar to my own, regarding typhoid fever in monkeys. Rayer in an article on "Fièvre Typhoide chez les Animaux," contained in the *Archives de Médecine Comparée*, 1843, mentions that during the months of November and December, 1839, typhoid fever broke out among the monkeys in the ménagerie of the Muséum d'Histoire Naturelle, Paris. On this occasion, M. Serres, who had previously observed the affection in monkeys, dogs, and cats, and had made careful preparations of the intestinal lesions, was able to make careful observations on the animals during life. The symptoms were very striking, being diarrhœa, increased frequency of pulse, and fever ending almost always in death. These observations of M. Serres and my own are, I believe, the only facts recorded regarding this disease in quadrumana.* No further opportunity for studying this affection presented itself until January in the present year (1885). The Zoological Society received, on deposit, six Canadian beavers apparently in the best of health. These animals had sojourned for a time at Liverpool previously to their transmission to London.

Not long after their arrival one of them died, and on making a *post-mortem* examination, I as surprised to find that the follicles of the intestines from the duodenum to the middle of the colon were ulcerated; the Peyerian patches from the middle of the jejunum to their termination at the ileo-cæcal valve were occupied with sloughs, the limits of which were determined by the size of the affected gland. In some of the patches the edges were slightly rounded and indurated. The majority of the ulcers had the muscular coat for their base. On making microscopic sections through the affected patches, no structure could be distinguished. The mesenteric glands were enlarged.

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* A case illustrating this question occurred recently in the Central Park Menagerie. A monkey, which had suffered from what was supposed to be simple diarrhœa with hemorrhage from the bowels, died, and a *post mortem* examination revealed extensive ulcerations of Peyer's Patches.—Eds.

The conclusion was that the case was one of typhoid fever, and that in all probability the five remaining beavers would die also. In this I was not disappointed; at least three of them came into my hands in the course of the next four or five weeks. At the end of that time it was deemed expedient to return the surviving two to their owner. Some two months later I learned that these two animals had recovered and were in excellent condition. The intestines in the other cases presented identical appearances. In one case the ulcers had penetrated beyond the muscular coat, and had given rise to intense peritonitis with abundant fœtid purulent fluid in the peritoneal cavity, but no perforation could be detected even on allowing a current of water to pass through the unopened bowel.

In two of the beavers the liver was the seat of some curious changes. The cut surface presented to the naked eyes numerous whitish specks just visible. On making sections through them the liver-cells presented a cloudy condition, and the hepatic cells in the immediate neighborhood of the abnormal specks presented a disintegrated appearance. Such phenomena are occasionally seen in human subjects who have died from this disease.

It is necessary to show that the disease is not tubercular. In the first place, tubercular ulceration of the bowels is, in animals, an exceedingly rare affection, indeed so rare that I have only once seen it, and that was in a coatimundi from South America, the subject of general tuberculosis. In this case, the appearance of the lesions was totally different, presenting a thickened nodular mass rising above the general level of the bowel, the peritoneum being involved in the thickening, and, what is still more significant, the tubercle-bacillus was present in enormous numbers; whereas, in the case of the beavers no tubercle-bacillus could be discovered, even after the most careful examination by myself or my friend Mr. Hudson, who quite independently submitted some of the sections to bacilli reagents.

In the beavers, the young ones were the first to succumb, and in them the intestinal lesions were the most marked. The disease extended over a period of six weeks altogether, the most obvious symptoms being disinclination for food and profuse diarrhœa.

The ulcers could be traced in the different parts of the small bowel, through the various stages from the normal condition to infiltration and sloughing, and in many parts the sloughing portion still sticking to the gut exhibited the peculiar bile-stained appearance so often seen in the human subject.

Lastly, I know of no other condition of the bowel, besides tuberculosis, likely to be confounded with them, and feel perfectly convinced in my own mind that we have here to deal with genuine typhoid lesions.

There have been many attempts on the part of veterinarians, particularly the French, to prove that the horse is liable to typhoid fever, but the diagnosis has been chiefly based on clinical grounds, and curiously enough, in outbreaks of what the French called typhoid fever in the horse the rate of mortality is so low as not to afford any opportunities of *post-mortem* investigation. I have not had an opportunity of studying the pathological lesions in either horse or ass. During the long vacation I made a special visit to the museum of the Veterinary School at Alfort. Some specimens of ulcerated intestine are there preserved, which present lesions exactly like those of human typhoid, but more particulars are necessary before one could decide with certainty that horses suffer from this affection. Coming back to the specimens concerned in this communication, I think it may be fairly claimed that they are really typhoid lesions, and that, with the solitary exception of M. Serres, they are the most authentic cases of typhoid fever yet recorded in animals. They possess a certain amount of value, for it is usually regarded impossible to inoculate an animal, other than man, with the typhoid poison. However, these cases prove that animals may acquire the disease, and are of tenfold more value than all the inoculation experiment that have yet been carried out on the transmission of this disease to animals, for up to the present time they have all been negative.

EDITORIAL DEPARTMENT.

NOTES ON THE ANATOMY OF THE DOLPHIN'S BRAIN.

Through the kind mediation of Mr. Eugene G. Blackford, of Fulton Market, New York City, Dr. E. C. Spitzka was enabled to obtain a large dolphin from the shores of North Carolina. The animal in question, which weighed 286 pounds, and was about eight feet long, belonged to the species known as the bottle-nosed dolphin (*Tursiops tursio*), and was a male. The brain weighed 2 pounds 12 ounces, and 5 1-2 drachms, apothecaries weight, that is a little over fourty-four and a half ounces, which is about the average weight of the human brain. Dr. Spitzka found the entire length of the spinal cord, measured from above the first cervical nerve roots to the end of the *conus terminalis*, to be 57 centimeters (22 1-2 inches), and relatively to the length of the animal, the shortest in the animal kingdom, reaching only to the middle of the dorsal fin. It was remarked that there was a singular disproportion in the length of the spinal segments; those of the cervical and lumbar region being very short, and those of the dorsal region very long, exaggerating the disproportion common among the mammalia.

ALTITUDE.	WIDTH OF SEGMENT.	LENGTH OF SEGMENT.	SPECIMEN NUMBER
4th Cervical Nerve.	12 Millimeters.	9 Millimeters.	—
8th " "	11 1-2 "	13 1-2 "	xxxi.
Upper Dorsal.	10 1-2 "	27 "	xxiv.
Middle Dorsal.	9 1-2 10 "	27 1-2 "	xxii.
Upper Lumbar.	10 1-2 "	13 "	xvi.
Middle Lumbar.	10 "	8 1-2 "	xii.
Lower Lumbar.	9 "	7 "	viii.
Upper Conus.	6 1-2 "	4 "	ii.

Below the lower lumbar level, the total length of the conus terminalis is 36 millimeters, it tapers gradually, and is rather blunt at the end. In man and in the mammalia generally, where the posterior extremities are well developed, the nerve roots from the lumbo-sacral enlargement of the cord are very much larger than those of the cervico-brachial enlargement; in the porpoise as in the seals, they are much smaller; indeed they are in the porpoise almost filamentous as compared with the powerful strands found in land animals, and the posterior nerve roots are much less voluminous than the anterior, with which fact the atrophy of the post cornu, particularly in its gelatinous portion seems to be in harmony.

As if to show beyond peradventure that the porpoise—for the dolphin, like the whale and grampus, is a member of the same family—is an animal depending on an exquisite space sense as a guide in its intricate movements, the auditory nerves were found to be of unusual dimensions; their transection resembled squares, with rounded angles, and they measured exactly seven millimeters in both short diameters. In other words, both auditory nerves together measured in the square area of their trans-section about 100 square millimeters, while the lower lumbar cord of the same animal measured only 85 square millimeters!

Dr. Spitzka states that new dissections will be necessary to demonstrate whether the demarcation between the oblongata and cord be as distinct in the porpoise as in the mammalia usually studied; certainly the transition is extremely gradual. The fourth ventricle is unusually long, measuring 55 millimeters in length. The *eminentia facialis* shows with uncommon distinctness (as the abducens nucleus does not rise up to disturb it); it is a straight elevation, running in the sagittal plane, and rising convex in the middle. It is similar as are also other venticular features to that of the horse, only that in the latter animal, the facial eminence is a little concave outwards. The length of each eminence, cephalo-caudad, is 10 millimeters; the width 2⅜ millimeters, and the distance between the two 4¾ millimeters. In no animal thus far examined does the median sulcus of the ventricle, sink so deeply in the anterior quarter as in the porpoise. An elevation is noted on the antero-lateral boundary of the ventricle, which runs as a distinct columnar fasciculus on the inner side of the post-optic lobes, into the lateral wall of the aqueduct, where it is apparently continued for some distance.

The facial eminences pretty accurately divide the ventricle into an anterior and posterior even half, as the distance from their posterior dive to the obex, is 23 millimeters.

When the enormous size of the cerebral hemispheres is considered, the smallness of the corpus callosum, which has been noticed by earlier observers, appears remarkable. Its length, absolutely is 50 minimums, but straightened out it would measure 7 millimeters more. Its *genu* and *splenium* each measure 5 millimeters in thickness, but its *corpus* only 2 millimeters. Dr. Spitzka is unable to find an anterior commissure (*precommissura*). There are rudiments of the inner division of the olfactory peduncle.

The discrepancy between the anterior and posterior pairs of the copora quadrigemnia is very great; in fact no animal with physiologically active visual organs shows so great a relative reduction of the anterior pair, except the opossum and the smaller bats; and even these do not show it to the same extent. The post-commissure is enormous, measuring 7 1-2 millimeters, dorso-ventrad and the supra-commissure, to which, as far as we know Wilder first directed attention, is exceedingly well developed also. The miscalled middle commissure shows the usual relations; there is a *distinct fifth ventricle* (pseudocele) and the pellucid septa resemble the human remarkably. The inner geniculate bodies are proportionate in size to the postoptic lobes, but not as convex as in the seal.

In his article on the Pyramid Tract, published in our last number, Dr. Spitzka spoke of a transverse mass behind the pons, about whose relations he was in doubt, and supposed it might be in relation with the auditory nerves. The excellent specimen now obtained, permits him to declare that *it is the trapezium*, which some recent authorities regard as connected with the auditory nerves, and he is thus able to add another to his numerous grounds for asserting that the cetacea have no pyramidal, *i. e.*, voluntary controlling tracts for digital motion, inasmuch as the trapezium extends uninterruptedly across, not being concealed near the middle line, as it is by the pyramid tracts in other animals.

The ventral fissure of the cord, becomes shallow, and ceases at the transition to the oblongata. The olives are rounded eminences, as described and figured by Leuret, and each has a slight latero-cephalic appendix.

Dr. Spitzka's statement comparing the elephant's brain to that of the cetacea, in which it is intimated that, to convert the former's brain into the latter, the frontal lobes should be curtailed and tilted, must be modified, and a definite opinion reserved, until the homologies of the fore-shortened brain of the porpoise are better understood. The most important projection tracts of the cetacea are the auditory and trunk-muscle nerves, and it is in accordance with this fact that we find the auditory nerve and the posterior commissure so very large. There could be no better illustration of the fact that the central nervous system in its morphology is a guage of the entire animal, reflecting its surrounding circumstances, than that of the dolphin. Wundt called the soul the "mirror of the external world," we may surely then designate the brain and spinal cord of the cetacea as the reflection of free ocean life. Here there are no solid rests for the feet, no claws to rend the prey. The gladiator grampus (*orca*) rushes among the other fish, snapping them up and swallowing them in its mad careering race, without any other guide than its accurate guage of distance and skill in trunk motion; porpoises tumble along at the rate of speed of a first-class frigate, and cohabit while so doing; the largest whales raise their huge forms out of the water, race along in herds, with swift and intricate gambols, and do not once come in collision. Obviously the main dependence of these animals in co-ordination is the action of the axial muscles, it is these that Meynert suspected to be under the control of the thalamus, and it is the thalamus and the thalamic tracts which preponderate in the cetacea. This single fact associated with the corelated absence of the pyramids accounts for the following: 1st, The large size of the posterior commissure; 2d, The absence of descending pons fibers; 3d, The large size of the tegmentum; 4th, The prominence and collision of the olives; 5th, The absence of a true ventral fissure for the whole length of the oblongata; 6th, The greater depth of the ventral fissure of the cord as compared with the dorsal fissure, and 7th, The preponderance of tracts in the tegmentum, whose homologues are not easily found in man.

Through the kindness of Professor Wilder, Dr. Spitzka had an opportunity of examining the hind brain of the manatee, as well as its cord. Some of the results are so interesting that we take the opportunity of presenting them with the sanction of both gentlemen, and with the express recognition of the former's right of priority in the elaborate and valuable field of inquiry he has made his own. The brain was in beautiful condition, Professor Wilder having preserved the entire animal and all its organs as a whole, by his method of continuous injection of alcohol.* The beauty of the ventricular cavities can only be appreciated by him, who has seen a brain preserved by this method. The facial eminences are apparently as prominent as, but less distinctly marked than in the porpoise; the entire organization of the pons and oblongata is low. While the pons in the dolphin† compares favorably in cephalo-caudad dimensions with the human, that of the manatee is no longer than that of the hippopotamus, and is shallow throughout. The diameter of the oblongata dorso-ventrad is remarkably even with that of the cord.

There is neither olivary body nor pyramid visible on the ventral face, but the eminence *A*, of Dr. Spitzka's diagram of the hippopotamus is distinctly marked, as it is also in the horse. The boundary between the posterior border of the pons and the oblongata, is scarcely to be identified near the medium line while near the cerebellum (medipedunculus) it is quite as well marked, and proportionately of about the same size as in the hippopotamus. The cerebellum of the manatee shows distinctly the ungulate type, which cannot be said of the cetacea who approximate the proboscidea on the one hand and in general physiognomy—even higher types. Dr. Spitzka states that the brain axis of the manatee presents the least distinct sculpturing among the mammalia. Taking the average development of the domestic mammals—be they carnivores or ungulates as the type; that of the manatee appears as a degradation, and that of the cetacea as a higher development. Is it to be wondered then that the *Rhytina Stelleri*, the Arctic manatee became extinct?

But even in this degraded mammal, a beautiful physiological contrivance is found: The hind brain and spinal cord are actually floated in an intricate plexus of blood vessels. It is true that the spinal cord of the porpoise is provided for in the

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***Alinjection. †It is shallow behind, but deep in front.**

same way, so that Dr. Spitzka was able to remove it without injury, by simply smashing the vertebral arches, but the plexus does not extend so far cephalad, to the disadvantage of brain development. It is perhaps difficult for him who has not the brain and its relations continually before him, to conceive the enthusiasm of him who having discovered in the pyramid atrophy of the porpoise, the reason why it is not a prehensile animal, sees in the defective pons of the similarly shaped but clumsy and less intelligent manatee, the reason why it does not race in mid ocean and tumble in the surf like the swift and intelligent cetacea.

The following series showing the intellectual rank (?) of animals, as guaged by the proportion of the square cord area to the cubic brain area, demonstrates the high position of the porpoise. Man, 50; porpoise, 76; ara parrot, 153; baboon, 177; sea-lion, 198; sun-bear, 217; horse, 294; squirrel, 1555; opossum, 1653; alligator, 3682; iguana, 4611. C.

RABIES.—From the Fortschritt d'Medicine we find this disease has suffered a most marked decrease in Bavaria during the last few years. In the year 1875, 485 dogs, 7 horses, 40 cattle, 14 sheep and 6 swine died from the disease. During the last seven years, there have been altogether 370 cases of rabies in dogs, 7 horses, 9 cattle, 7 sheep, and 5 swine, 39 human beings were bitten—fatality not given.

In Vienna, 196 dogs were admitted to the Veterinary Hospital during the year 1884, as either rabid, or suspected. Of these, 178 were living when brought to the school; 134 of the same died of furious rabies, and 27 of the dumb, or still form.

Forty-seven head of cattle were bitten by rabid dogs and died from the disease in one locality in Prussia, in the year 1883. Seventy-four persons were bitten by rabid dogs, in Prussia, in the year 1884-5; four died. Period of incubation 21, 39, 77 and 156 days.

SCIENCE AND THE STATE.—Our readers will find this subject fully discussed in "Mind and Nature," for February, by Dr. R. W. Shufeldt, U. S. A. No impartial thinker on the subject will deny that science exercises a powerful influence in the advancement of all matters pertaining to the welfare and progress of human affairs, nor that good government is an important factor in promoting it. We firmly believe so and would recommend our Legislature to hasten to avail itself of such a valuable guide as science has proved itself, and to do the utmost to aid it. In no way could it do so better than by endorsing the plan submitted by the author of the above-entitled paper and putting it into operation as soon as possible. C.

TRICHINIASIS IN PRUSSIA IN 1884.—In the Archiv fur Thierheilkunde, we find there was an average of 1 Trichinous in every 1,741 hogs examined in Prussia during the year. The number varied very much in different localities, for which there must be some ascertainable reason—it prevails much more in the hogs of East than in those of West Prussia. In Posen 744 trichinous were found among 154,004 swine: 1 to 193; again at Bromberg of 43,345 swine examined, 161 were trichinous: 1 to 269. In Dusseldorf, only 1 trichinous hog was found among 57,882: at Wiesbaden, 1 to 20,672; at Muiden, 1 to 30,146; at Arnsberg, 1 to 12,362. At the Berlin Abbatoir, 196 trichinous were found in 258,538 hogs, 1 to 1,311.

Trichinæ were found in 41 of 1,724 pieces of American pork at Stettin, but such statistics have no comparative or reliable value whatever.

In the village of Norndorf, having 600 inhabitants, there was an endemic of trichiniasis complicating 86 people—12 died. One hog was the cause of it all. The hog was examined by an examiner, and pronounced "free" from trichinæ, but the result found that he could not be trusted.

In another place, there were 17 cases in human beings, of whom 4 died.

Measels is very prevalent in German hogs.

CASTRATION OF THE HORSE.—A number of our readers have asked for the mode of treatment after the ecraseur has been used on the horse. It is conceded by professional castrators who use the ecraseur that 24 hours after the operation, when swelling takes place, the wounds should be kept open by inserting the four fingers, bathing the parts with hot water once or twice a day, keeping the end of the spermatic cord free from attachment to the integuments, and driving the animal daily. The object of the latter is to prevent the parts from swelling. When driven daily or exercised freely, the swelling decreases, the wound heals quickly, and no bad results follow.

TUBERCULOSIS IN THE HORSE.—Recuill d. Med. Vet. 1884, Trasbat reports a case of this very rare complication in the horse, which on that account is worthy of consideration in detail. He first mentions having presented to the Société (Central de Med. Vet.,) in April, 1878, the lungs, liver, and organs of a horse that had been killed on account of suspected glanders, but the autopsy revealed phenomena, which differed essentially from the pathological characteristics of glanders, sarcoma, carcinoma, and lymphadenitis, and which he then looked upon as speaking decidedly for the tuberculous nature of the disease. The gentlemen present did not, however, coincide in this conclusion. Lately another case came to hand which he investigated most carefully in connection with his colleague Professor Norcord, and successfully proved the disease to be tuberculosis.

The microscopic examination of the neoplasms revealed by the autopsy, gave unmistakable evidence to the presence of tubercle bacilli in great numbers; the sections having been treated by the differentiating method of Ehrlach.

The chief intra vital phenomena were; an excessive degree of emaciation; augmenting labored respiration without any ascertainable indications of the existence of pneumonia; a short, painful cough, with some nasal discharge, continuous fever with exacerbation evenings; fitful appetite, bronchial rales, polyuria to an excessive degree. He suggests the possible, practical value of the examination of the nasal discharges in such cases.

Autopsy: The spleen was normal in form but weighed two kilos, its entire surface was covered with numerous neoplasms of variable dimensions and color, its pulpa was also invaded by the same; cheesy degeneration of their center failed. A large tumor with caseous degenerated interior situated behind the pancreas. Lungs failed to collapse on removal. Pluræ smooth, with a few circumscribed indurations here and there. Numerous neoplasms distributed through their substances from sub-milliary to the size of a walnut; they all had a spherical form and were not sharply circumscribed in the pulse-tissues, the larger nodes caseously degenerated in center. They developed in the interlobular tissues and caused atrophy and compression of the pulmonary tissue. Respiratory mucosa normal except in bronchials, where there was catarrhal swelling and viscid secretion. Cause unknown.

TUBERCULOSIS IN A DOG.—At the meeting of the Société centrale de Med. Vet., 26th February, 1885. Nocord reports a case of Dr. Andrien, in which he found tubercle bacilli in the organs sent to him for examination.

Autopsy: Muscles anæmic, abdominal cavity contained a quantity of clouded fluid; omentum and its lymph glands—latter hypertrophied—the seat of numerous milliary and sub-milliary noduli; dispersed neoplasms in the capsule of the liver and spleen as well as the serosa of the bladder. Considerable senus effusion in thorax; pleura indurated here and there, in such places numerous noduli as above were to be seen. Bronchial lymph glands hypertrophied, on cutting cross section cavity in the body of gland, noduli dispersed through the lungs. Heart, trachea, and larynx, normal.

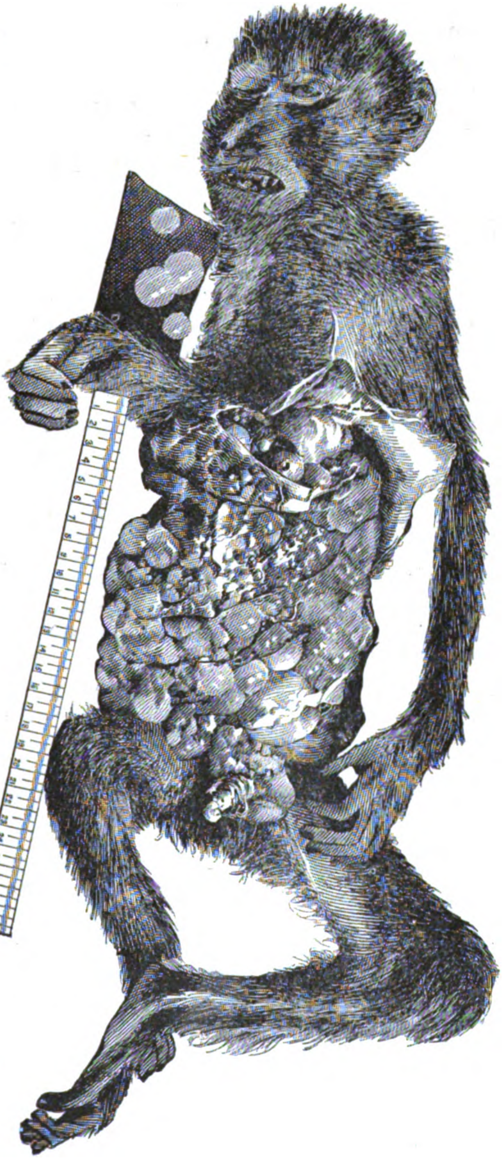
GLANDERS AND PLEURO-PNEUMONIA IN PRUSSIA.

Fifteen hundred and twenty-five horses were killed by the authorities, on account of glanders, during the year 1884-85. The sum of $87,698.24 was paid as remuneration to the owners of the animals. Three thousand and eighty-four cattle were also killed by the authorities on account of the contagious lung plague; six per cent. of these were found to be free from the disease on being slaughtered. The owners received in remuneration the sum of $167,776.02.

CASE DEPARTMENT.

AUTOPSIES AT CENTRAL PARK MENAGERIE.

PIG-TAILED MONKEY (*Macacus Nemestrinus*).



Made Oct. 17th, 1885. Body somewhat emaciated. Rigor mortis moderate.

Abdomen distended and tense, but affording no distinct fluctuation. Upon incision, it was found to contain a large number of cysts, covered by a layer of the omentum, but some escaping from beneath it through some holes which either pre-existed or were produced when the confining tension of the abdominal walls was removed. No ascites. The cysts appear to be nearly all situated within the omentum, and but for ruptures in the latter, might be lifted out of the abdomen within it. There were a few, however, beneath the peritoneum in the pelvis, which they nearly filled. The cysts varied from the size of a hen's egg to that of a pea, and those collected weighed 46 ounces.

The intestines, stomach and kidneys were apparently normal. There were adhesions binding the liver to the diaphragm, right kidney and transverse colon. The right and middle of the three chief lobes of the liver appeared normal but for slight thickening of the peritoneal covering, due to perihepatitis. The left lobe was nearly entirely replaced by a cystic tumor the size of a hen's egg, with tough, opaque walls, which upon section proved to be multilocular.

The lower end of the spleen was involved in a mass of small cysts situated in the gastro-splenic omentum.

When the thorax was opened, the left side presented two large cysts—one above and one below—which nearly filled the thoracic cavity on that side. Between these cysts was the heart, lying in a transverse position, the apex towards the left and rotated, so that the right side of the heart was directed forwards. The lower cyst was behind the left bronchus and the vena cava inferior, and its great bulk to the left of those structures. The bronchus was much elongated (five or six times as long as that on the right side, which appeared to be normal) and compressed, but was still pervious, as shown by injecting water into the trachea with very moderate force (a one-foot head of water was the force employed). The phrenic and pneumogastric nerves showed no signs of compression or injury. The lung on the left side was almost completely compressed below the cyst, between it and the diaphragm, being capable of crepitation over only a small area. It could be partially inflated after being freed from the adhesions which bound it to the diaphragm and the cyst. Within it was discovered an echinococcus cyst about the size of a large pea. The lower of the two large cysts had upon its upper and right aspect a dark reddish layer, wholly unconnected, as far as could be discerned with the unassisted eye, from the lung tissue already described. This, upon microscopic examination, proved to be pulmonary tissue. The inference drawn from the appearances was that the lower of the two large cysts originated within the lung, and by its growth produced compression and atrophy of the lung tissues. The upper cyst was only connected with the lower one by adhesions, and the tissues about it were so altered and adherent that no indication of its original seat could be obtained.

The right lung was here and there atelectatic, but otherwise apparently normal.

Heart, to outward appearances, normal. It was not opened.

The cysts possessed laminated gelatinoid walls, enclosing fluid contents of a clear, transparent, somewhat yellowish character. They were unilocular except the large one in the liver, and possibly one or two others which were broken when found. Several, which were more minutely examined, contained from ten to thirty scolices, each of which possessed thirty to forty hooklets, but no evidence of suckers. They were thought to be echinococcus veterinorum, as described in Birch-Hirshfeld's "Pathologische Anatomie" (1877).

EDWARD K. DUNHAM, M.D.

TIGER (*Felis tigris*).

Full-grown female, December 10, 1885: autopsy ten hours after death.

Rigor mortis slight, adipose tissues wasted in some places—notably the abdominal region—showing gelatinous transformation.

Thoracic organs.—The lungs presented an advanced phase of necrosis, large cavities had formed, filled with putrid gas or air, the latter communicated with the bronchi, the others were, one of them, incopulated on all sides. Another, consisting of a mere bag of pleura, and a little ragged and necrotic lung tissue, lay in such a situation that in the half-dark room it was taken for a hydropic pericardium till an incision, the resulting escape of gas, and the ulcerated cavity left behind, dispelled the illusion. The bronchi were filled with a frothy, foul material, glairy in the larger, and more detritus like in some of the smaller bronchi. The bronchial glands were enlarged, strongly pigmented, and two of them showed a cheesy center. Several of the bronchi of the second sub-division showed bronchiectasis, one such dilatation had a ragged ulcer at its floor. All contained a more or less purulent. glairy material, and the lining membrane, where not ulcerated, was thickened. Scattered throughout the lung substance, which in the middle and upper lobes of both sides was consolidated, there were numerous nodules of a cheesy character, many of which showed signs of breaking up. They were all of them lobular in character, and the bronchus leading to them was inflamed, thickened and usually blocked up. There were a few pigmented pleural adhesions of recent formation.

The right side of the heart was slightly hypertrophied, the valves and endocardium were normal.

Abdominal Cavity.—Gastro-intestinal tract: the stomach and intestines were empty, excepting the colon descendens, which contained normal fœcal masses. There was no evidence of disease. The liver and spleen, which latter was strongly pigmented, were also structurally healthy. The kidneys were intensely congested in both the cortical and medullary portion. The bladder was empty and healthy, as were also the generative organs. There was a large corpus luteum (corpora lutea of pregnancy) in each ovary, distinctly organized, and nearly two centimeters in diameter.

Head.—The brain, which showed no distinct anomaly, was unusually soft in its anterior portion, the blood in all the cerebral vessels was of a serous character.

The membrane lining the right tympani bulbs was greatly thickened, while on the left side it was thin, colorless and transparent. It was here yellowish brown, beautifully injected by a rich net-work of blood vessels, and opaque. The membrane tympanic of this side was also thick and opaque, the membrane lining the ossicula injected.

Post-mortem Diagnosis.—Evidence of a general catarrhal attack of long antecedence—probably a year—localizing especially in the respiratory tract and the right tympani cavity, and resulting in bronchiectasis, atelectasis and catarrhal pneumonia, with terminal formation of vomicæ. ⁂

Proceedings Veterinary Medical Societies.

COMMENCEMENT AMERICAN VETERINARY COLLEGE.

The eleventh annual commencement of the American Veterinary College was held at Chickering Hall, New York City, on Monday evening, March 1. Twenty-eight young men formed the graduating class, and had the degree of Doctor of Veterinary Surgery conferred upon them by the President, Samuel Marsh. The valedictory was delivered by Robert Corwin Jones. Addresses were made by several of the trustees. The following is a list of the graduates: Messrs. D. C. Ashley, of Massachusetts, E. B. Buckley, of Connecticut, M. L. Bignell, of Pennsylvania, S. Bradley, of New York, C. E. Bridge, of Pennsylvania, J. S. Candee, of New York, J. J. Cattanach, of New York,

E. A. Child, of Florida, A. J. Dodin, of New York, Th. H. Doyle, of New York, F. H. Flagge, of New York, F. W. Hopkins, of Ireland, R. C. Jones, of New York. C. Kuenhe, Ph. G., of New Jersey, W. J. Magee, of New York, B. F. Munich, of Pennsylvania, F. W. Meyer, of Pennsylvania, Maurice O'Connell, of Massachusetts, A. W. Radley, of Pennsylvania, A. K. Robertson, of Iowa, H. Schmidt, Jr., of Ohio, A. Strang, of New Yok, M. R. Trumbower, of Illinois, G. G. Vanwater, of New York, G. L. Warner, of New York, J. A. Wolwrath, of New York, R. Weir, of Mass, A. C. Young, of Utah. The prizes were carried off by Dr. G. L. Warner the gold medal of the Board of Trustees; Dr. A. Strange, that of the N. Y. State Veterinary Society; Dr. A. C. Young, the prize of the Alumni Association; Dr. F. W. Hopkins, and Mr. J. D. Fair, the anatomical prizes.

COMMENCEMENT OF NEW YORK COLLEGE OF VETERINARY SURGEONS.

The commencement exercises of the New York College of Veterinary Surgeons were held at the college building, 332 East 27th street, on Thursday evening, March 18, 1886.

Diplomas were granted to the graduating class as follows: George W. Gilbert, Long Island, John S. Shiffert, Pennsylvania, John J. Foy, New York City, J. T. D. Donnelly, Long Island, Otto A. A. von Lang, Brooklyn. N. Y., Fremont L. Russel, Maine, J. A. Breakell, M.D., New York City.

The Faculty Prize, a gold medal, was awarded to Geo. W. Gilbert for the best general examination. Dr. R. McLean's prize, a silver medal, was awarded to James McKee for general best junior examination Prof. Comstock's prize, a veterinary pocket case of instruments, was awarded to Geo. W. Gilbert for the best examination in anatomy. The Jenkins Prize, $10 worth of veterinary books, was awarded to J. T. D. Donnelly.

Prof. J. McLean, of the Faculty, addressed the students in his usual happy manner, and gave them some good advice. G. W. Gilbert delivered the valedictory.

The Spring Term will commence on March 29th, and continue until the middle of May.

Dr. Peters, having removed from the city, no longer holds any official connection with the college.

Progress of Veterinary Science.

Veterinary Medicine in Prussia.—The annual appropriation for the expenses of the veterinary school, and the salaries of the veterinary police in Prussia for the year 1886 is $189,333.93.

Cocaine Poisoning in a Cat.—Dr. H. J. Boldt presented, at a meeting of the New York Pathological Society, the brain and medulla of a cat which had died in convulsions twelve minutes after an injection of eleven minims of a thirty-three-and-a-third-per-cent. solution of cocaine. The first effect noticed was a sort of leaping gait with dragging of the hind extremities. followed by convulsions. There was simulation of the Cheyne-Stokes respiration. The temperature in the rectum after death was 104° F. At the autopsy, made half an hour after death, the vessels of the pia mater in both brain and cord were much congested, there was an extravasation of blood in the fourth ventricle, also a small amount in the anterior part of the medulla, and there were minute extravasations throughout the brain. The lungs were collapsed, and contained no blood; the right ventricle of the heart was overdistended, the left one empty. There was congestion of the gray substance of the cord. Dr. Boldt said that death seemed to have taken place from paralysis of the respiratory center.

RECTUM OF THE ARMADILLO.—We have been struck in the case of two armadillos we recently dissected, with the presence of an enormous dilatation of the rectum filled with earth. In one case, this dilatation certainly contained eight cubic inches of earth. Does the armadillo swallow the earth with its food, and it then accumulates thus, or does a paralysis of the sphincter occur in captivity, and the earth force its way in? It scarcely seems as if such a state of affairs could be physiological, and it must be a source of discomfort, if not of danger, for in the one instance the empty *pupa* of the carrion-fly were found in this earth in large numbers. ⁂

IMMUNITY FROM CONTAGIOUS DISEASES.—Drs. D. E. Salmon and T. B. Smith have just published ("Proc. Biol. Soc. of Washington," Vol. III. a remarkable discovery made by them of a new method of producing immunity from contagious diseases. By experimenting upon pigeons, they were able to establish an immunity from the disease known as swine-plague by the inoculation of solutions, in which pathogenic bacteria had been cultivated, and afterwards destroyed by heat. The conclusions they reached are as follows: Immunity is the result of exposure bioplasm of the animal body to the chemical products of the growth of the specific microbes which constitute the virus of contagious fevers; 2d. These particular chemical products are produced by the growth of the microbes in suitable culture-liquids in the laboratory, as well as in the liquids and tissues of the body; 3d. Immunity may be produced by introducing into the animal body such chemical products as have been produced in the laboratory.—*Science.*

OBITUARY.

DR. FREDERICK ROLOFF.

Late Director of the Royal Veterinary School, Berlin. Roloff was a most perfect example of that peculiar creation—a Prussian bureaucrat. His mind was of that narrow mould that would only permit him to work according to the strict letter of the law. He had a regular clock-work brain, which being wound up, ran the same all his life, and believed that all the knowledge in the world was centered on men of his own age.

That these views are somewhat shared in by our German colleagues may be seen by the following quotation from Dr. Adam, in the *Wochenschrift fur Theirheilkunde*, No. 1, 1886, p. 11: "When Roloff was promoted to the Directorship of the Berlin Veterinary School, the entire veterinary profession looked to him to ably support the interests of that school and the advancement of the profession in Germany, as well as in Prussia. He has, however, done nothing whatever in either of these directions. He even, while occupying the position of Director at the school, assumed another in connection with the Imperial Board of Health, in order to prevent any other member of the profession occupying so highly honorable a position as an independent individual."

T. S. COBBOLD, M.D., F.R.S.

We regret to announce, as we go to press, the news of the death of the celebrated helminthologist, T. S. Cobbold, M.D., F.R.S., formerly Professor in the Royal Veterinary College, with whose writings our readers are familiar.

REVIEWS.

ANTHROPOID APES. By Robert Hartmann, Professor in the University of Berlin. With illustrations. New York: D. Appleton & Co., 1886, being Vol. LII. of the "International Scientific Series."

This work may be regarded as a sort of review of our past and present knowledge of these interesting animals, whose proximity to the human species in anatomical structure and intelligence has been the theme of naturalists and physicians, and the bane of more orthodox people during the past twenty years. As such it presents a fair view of our existing knowledge on the subject, without demonstrating anything novel, or being, indeed, in any respect very exhaustive. The author has himself had the opportunity of dissecting all species of the anthropoid apes, and has made a laborious analysis of the muscular variations, but regarding the visceral, cranial and cerebral characters of these species, he adds little or nothing, and does not even give a full abstract of the results of others. The work is lacking in vigor and originality. It may lay claim to being a good compilation, and in some respects, at least, falls short of its models. Thus, the first chapter, the one dealing with the history of our knowledge of the subject, is undoubtedly a reproduction of the opening chapter of Huxley's "Man's Place in Nature," yet how vastly superior in elegance of diction and interest is the latter over Hartmann's lines.

It is possible—for we have not seen the original—that the defects we notice are due to the translation, which has struck one other reviewer * as presenting inherent evidences of clumsiness. We refer to this confirmation lest we might be deemed to be hypercritical. We have, in turning over the pages of of this book, come across a number of instances of bad translation, and one of these, at least, deserves to be immortalized. On page 197, the text reads *verbatim et literatum*; "Bishoff asserts that the frontal convolution is very slightly developed in the chimpanzee, orang and gibbon. 'Its great development in men,' Gewahrsmann writes, 'constitutes one of the most marked distinctions between the brains of apes and men." To this citation there is appended a reference to the work of Bischoff showing conclusively that the translator has created a new authority by the name of 'Gewahrsmann.' The fact is, that the reference in the original is to Bischoff, who is spoken of as the *authority* or *Gewahrsmann* for that statement. We know of but one other authority created by a pretender to foreign literary knowledge, and that was "Beitz," cited by Dr. Allan McLane Hamilton, and due to a similar misappreciation of a German abbreviation.

The illustrations, as a rule, are good, and a sufficiently large number accompany the text to illustrate the subject. But in one instance, at least, the author has shown a lack of judgment. In selecting a type of savage to test the approximation of the lower human forms to the higher apes, he pitches upon the Zulu king, Cetewayo, and two of his subjects. It would have been, in our opinion, bad enough to take any Zulu, which is one of the noblest types of the savage, but it was much worse to select one of the exceptionally ablest warriors and diplomatists that race has brought forth. And in representing the lowest human type, Hartmann has been equally unfortunate. We do not need to go five hundred yards from where we are now sitting to find a negro exhibiting a far more ape-like appearance than the "hairless Australian" of page 88. Under these circumstances, we are not surprised at finding Hartmann reluctant to admit the pithecoid resemblance of the lower human races, a resemblance that no physiognomist can fail to detect.

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* In the New York Times.

A number of the cuts seem to have been thrown in without any regard to the text, quite a number of non-anthropoid apes are thus represented. Whether this is a publisher's measure or not, we are unable to say; if the fault of the author, it is certainly very bad taste, as it tends to give a preponderance to to the views of those who would widen the chasm between the anthropidæ and the anthropomorpha.

While we are not surprised to find the American authors who have written and in part, at least, made original observations on the cerebral and general anatomy of the chimpanzee and ourang-outang, not referred to, for it is rather the custom of our German friends to think of America somewhat as certain people in Judæa thought of Nazareth, yet we would venture to direct Professor Hartmann's attention to some exceedingly painstaking researches of Wilder, demonstrating that the brain of the anthropoid ape (chimpanzee) overlaps the cerebellum. In case he condescends to follow Wilder's methods or to accept his measurements, may, if he were but to see through an anthropoid skull in the sagittal plane, he will learn better than to offer his readers such a caricature as the woodcuts of a gorilla's brain in pages 193 and 196. Even a dog would blush to have so flat a basi encephalic axis as is there shown.

The very worst part of the book is that relating to the brain, and this is scarcely to be wondered at as the compiler, Bastian, is cited as the foremost investigator on the subject. The author says—on what authority, we are not informed—that in Mongolian, Indian and Negro race, the cerebellum is imperfectly covered by the cerebrum. If the human brain is treated in the same way as the afore-mentioned gorilla brain, such a result will be obtained, but not otherwise. Hartmann says that the gorilla has more complex convolutions than the chimpanzee, but the photograph does not compare over favorably with the brains of some of our chimpanzees. What he means by saying that "there are instances" where the fissure of sylvius is *not* overlapped by the speculum, we are at a loss to conjecture. In this connection we discover another example of the fearful translating ability of our "Gewahrsmann." "In these three anthropoids, as Bastian justly observes, it is less horizontal than in man, and occupies a position more like that which it takes in the black sea-cat monkey, the wanderers, and other macacas." (page 195).

On page 197 he has "a soft and thick anterior commissure of the third cerebral ventricle." On the next page is the following incomprehensible jargon: "In the lateral ventricles more of the characteristics described in the human brain are absent. The four eminences (?) resemble those of man, nor does the fourth cerebral ventricle present any remarkable differences of form." Aside from the nonsensical translation of "vierhügel" (corpora quadrigemina) into four eminences, which the context would lead one to fear, the translator regarded as contained in the lateral ventricles, these statements are wrong. The lateral ventricles are very similar, and the four less so in the anthropoid group and man.

We regard it as unfortunate that a prominent publishing house should publish so poor a translation. Of course the system followed in the international series, by which the translator remains anonymous is calculated to have a bad effect every way. In the first place, by not venturing to publish the name of the translator, the publishers make a *quasi* confession that they intrust their work to some mechanical drudge, ignorant of the first principles of the science with which the work to be translated deals. In the second place, this system engenders carelessness on the part of the translator, for as his name remains unknown, he has no reputation to lose or to gain, by a good or bad translation.

We think, taking it all in all, that the important subject with which Professor Hartmann's work deals admitted of a better and more fascinating dress, and demands a more careful presentation than that of the translation before us.

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ESSENTIALS OF VACCINATION. By Dr. W. A. Hardaway. Published by J. H. Chambers & Co.—St. Louis. 1886.

This little volume is a compilation of the main facts relating to a very important subject, about which much has been written, *pro* and *con*, and clearly has a *raison d'etre* at the present moment.

When a scientist like Herbert Spencer is found among those arrayed against such a long-established fact as the protective efficacy of vaccination, we appreciate the necessity of taking up arms in its defence. This Dr. Hardaway has done, and in dedicating it to Dr. Frank P. Foster, pays a just tribute to the scientific services of the most distinguished vaccinographer of the day.

BOOKS AND PAMPHLETS RECEIVED.

THE SKELETON IN GEOCOCCYX. By Dr. R. W. Shufeldt, U.S.A. Reprint from the *Journal of Anatomy and Physiology.* London: January, 1886.

TRANSACTIONS OF THE AMERICAN DERMATOLOGICAL ASSOCIATION. Ninth Annual Meeting held at Greenwich, Conn., August, 1885.

A NEW DEPARTURE IN UTERINE THERAPEUTICS; THE DRY TREATMENT. By George J. Engelmann, M.D. St. Louis.

NOTE BOOK FOR CASES OF OVARIAN AND OTHER ABDOMINAL TUMORS. Adapted from the note books of Sir Spencer Wells and the Samaritan Hospital, London, by John Homans, M.D. Published by Cupples, Upham & Co. Boston.

CONSTITUTION AND BY-LAWS OF THE VETERINARY MEDICAL ASSOCIATION OF NEW JERSEY. Paterson: 1885.

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ORIGINAL COMMUNICATIONS.

ART. XII.—FEBRILE INTERMITTENT DIARRHŒA IN CAMELS.

BY RICHARD W. BURKE, M.R.C.V.S.,
Army Veterinary Department, Cawnpore, India.

The importance of obtaining reliable information regarding diseases of the Camel in India, is so generally recognized as to call for little comment. It is sad to reflect that the frequent mortality among Camels in all large transport stations throughout the country is so high—a circumstance attributable in a very large measure to the indifference or culpable neglect shown in the care of transport animals, and the paucity of Veterinary Surgeons to effectually cope with outbreaks of contagious disease under similar circumstances.

We have only recently brought to a conclusion our endeavor to suppress an outbreak of Anthrax in Camels, an account of which appeared in the *Veterinary Journal*, for January of this year, and we wish briefly to describe an Enzooty of Febrile Intermittent Diarrhœa in those animals. We find diarrhœa due to so-called "Abdominal form of Anthrax," observed by many veterinarians, not of that nature. From the study of clinical facts, we must draw the conclusion that the disease is caused by the *fungus malaria*, and is nothing else but febrile intermittent diarrhœa. The animals in question were employed in removing dung heaps for the space of about two months, when an enzooty of intermittent diarrhœa, very fatal in its character, was seen to follow, with such marked pertinacity, that a Veterinary Surgeon was consulted.

Some have maintained that true Anthrax may thus be produced, and to this they ascribe many of the remarkable successes obtained through the use of carbolic acid.* The good effects once hoped from the internal administration of carbolic acid are seen not to be obtainable, or only to a very limited extent, and in a small percentage of cases. Except in a few cases mentioned, carbolic acid has little influence on the diarrhœa of camels, which is intermittent in character, and nearly always proves fatal in its effects. The temperature at the height of the fever was in the majority of cases, 105° F., and fell in the remissions, having a periodic tendency, to 99°F. If acute diarrhœa cannot be checked, the result is increased activity, of the bowels, inanition and rapid death. Better results were obtained when sulphuric acid dil. with opium, was used instead of the carbolic, and chloroform † when the fœces contained much mucous shreds or blood; but I would urge a trial of the action of acid sulphuric on a larger scale and in a greater number of cases, and a more extended clinical observation of the results obtained, before the precise significance of the treatment is recognized.

In treating this disease, the diarrhœa must be checked, as well as the system supported, as the strength of the patient must be sustained to a point which shall overcome the weakening influence of hyperaction of the bowels.

The only pathological condition met with on post-mortem examinations was congestion of the mucosa of the intestinal tract, more or less throughout its whole extent, with patchy elevations due to gelatinous exudation, containing the *fungus malaria*—a filamentous many-jointed organism, which grows readily in blood-serum, urine, gelatin, ordinary gum, rice—konjee and other media. Before cultivation they often appear only as simple small rods, recognizable only under the higher powers of the microscope. Mounted fresh on glass plate and examined under a 1-12 obj. (Benèche), they could be easily recognized.

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*Vratch, No. 10, 1885, p. 146; et Vratch, No. 27, 1885, p. 428.

† Journal de Med. et de Chirurgie Pratiques, April, 1885,

The spleen and other organs did not appear to be the seat of special disease, beyond slight congestion noticed in a few cases.

Whilst many of the fungi may be eaten with impunity, others contain toxic principles which are of interest clinically and pathologically. Agaricin, the alkaloid of the agaricus laricis or larch agaric, and muscarin, which is derived from the agaricus muscarinus or fly agaric have long been known. More recently several other fungi have been examined and their toxic action determined.

The Helvella esculenta is a mushroom-like fungus which is usually described among the edible fungi, but in several cases has produced serious symptoms of poisoning. Vomiting, diarrhœa, abdominal pain, icterus, convulsions, etc., have followed its use as food, these symptoms, on several occasions, terminating in death. Bostroem * pointed out that besides diarrhœa and vomiting, it causes in dogs hœmoglobinuria, followed sometimes by complete anuria; consciousness is lost, the reflexes disappear, but the breathing is frequent and the heart beats with vigor. Icterus, due to the dissolution of the red corpuscles, is frequently present, and dyspnœa likewise occur. Ponfick † has recorded similar symptoms after the exhibition of this fungus. Boehn and Kulz ‡ confirm the physiological and pathological effects noted by the above observer.

The Boletus luridus is a fungus found chiefly in woods; it is of a dark brown color, and often of considerable size,

The Amanita Pantherina is closely allied to the Amaniat muscaria, from which it differs, indeed, chiefly in the color of its cap, which is brown, whilst the fly agaric is red.

The action of Cholin, often called Neurin, on man, has no been determined. It has been found in the Helvella esculenta, Boletus iuridus and Amanita pantherina, as a white crystalline substance. In frogs it causes general paralysis, with twitching

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* Deut. Arch. fur. Kl. Med,, 1882, p. 209.

† Virchow's Archiv., vol. 88.

‡ Archiv. f. exp. Path. und Pharm., 1885, vol. xix, pp. 403-414.

and trembling of the muscles; in rabbits it caused salivation, but large doses produced no paralysis or other nervous symptoms; in cats, besides salivation, the administration of Cholin was followed by great weakness in the hinder extremities and general paralysis.

Glause and Juchsinger * have examined the action of Cholin, muscarin and other bases; they affirm the muscarin action of all, and from their experiments conclude that muscarin paralyses especially the heart muscle, and that this effect is antagonized by atropin.

ART. XIII.—HOW CAN WE PREVENT FALSE HYDROPHOBIA? †

BY E. C. SPITZKA, M.D,

Consulting Neurologist to the North Eastern Dispensary; Attending Physician Department of Nervous Diseases of the German Poliklinik; W. & S. Tuke Prize Essayist.

Gentlemen :—If compelled to apologize at the outset, for the fact that the preamble of my paper is so lengthy, as compared with its conclusion, I think I can justly refer to the obscurity which still enshrouds the subject of hydrophobia, in palliation. I do not believe that there is another branch of inquiry, in which time-honored tradition, erroneous observation, ill-balanced reasoning, and immature theory play so large a part as in that relating to the transmission of rabies from animals to man. If I deal more with the question of spurious than with real hydrophobia, it is because my experience with the former is considerable, and with the latter infinitely small; indeed I would say *nil*, but that I wish to avoid discussing a question both whose sides are represented by able thinkers and observers, whether there really is such a thing as genuine hydrophobia in man, due to transmission from lower animals *and to nothing else!*

In view of the length of the preliminary portion of the paper I think it well to announce its propositions and problems at the outset, as then, my aim in the body of the paper may appear more clear :—

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* Fortschritte d. Med., 1884, No. 8, p. 276.

† Read under the title of "The Attitude of Legal Medicine *versus* Hydrophobia," before the Society of Medical Jurisprudence and State Medicine, at the Hall of the Academy of Medicine, June 10th, 1886.

I. There is, at present, no proven epidemic of hydrophobia either in New York city or in its vicinity.

II. A number of deaths have occured from spurious hydrophobia, (lyssophobia), in New York city and its vicinity, during the past nine months.

III. The agitation of the subject of Pasteur's method of preventive inoculation, for hydrophobia, and the accompanying strained accounts of suffering and death from that disease, are responsible for these deaths.

IV. To prevent the serious and oft-times fatal imaginary disease, it is necessary to inculcate a healthy public sentiment, which shall frown down the agitation of questions, which are of a strictly scientific character, by persons who are neither biologists nor physicians, and who have no other motive than the creation of a sensation, regardless of consequences.

V. It should be strictly inculcated on all officers entrusted with the preservation of the public peace and public health, that the only way to determine whether a dog is suffering from rabies or no, is to submit him to inspection by competent veterinarians in a living condition. The desirability of some such ordinance is attested by the fact that persons on the road to death from hydrophobia, have recovered on learning that the dog who bit them remained alive and well.

VI. The results of researches on hydrophobia, should, for the present, remain within the domain of technical literature. There are so many problems connected with the question of rabies, which are as yet, and promise to remain for some time, unsettled, that it would be tantamount to criminal recklessness to publish prematurely alarming discoveries in the lay press.

VII. The method of demonstrating rabies by direct inoculation of the brain is fallacious: The conclusion drawn by Liautard, from an experiment thus performed, that the Riverdale dog was mad, was obtained by misleading methods.

VIII. The means to be adopted to prevent future outbreaks of spurious hydrophobia, is to muzzle the dogs, to dam up the torrents of ink flowing from the pens of hasty investigators within appropriate receptacles, and to exclude sensational publications from the household.

Probably the most seriously misunderstood and misrepresented members of our community, at the present moment, are the various representatives of the species *canis familiaris.* When a journalistic hydrophobia becomes established, these unfortunate beings are not allowed the wretched privilege of falling ill of any other disease than the one which it has pleased some magnate of the press to declare epidemic. If a dog does not eat, he has hydrophobia; if he draws his tail between his legs, beware! if his eyes have a strange expression, or, what is the same thing, if you think they have, shoot him on the spot! If he resents your fooling with him, get your doctor to open a subscription for you and start for Pasteur's laboratory by the next steamer, at reduced rates! Hereafter, canine pathology will prove an easy science to master. It will consist of but one simple syllogism, as follows:— All symptoms of canine disease are symptoms of hydrophobia; all dogs presenting such symptoms should be destroyed; hence, for all sick dogs there is but the remedy of the bullet or the policeman's club.

Am I exaggerating? Have you followed up the history of the so-called epidemic since the needless, wanton and wicked agitation of the matter was begun a few months ago? Do you remember that for a week after the first flaming announcement was made relative to the Newark epidemic, several scores of cases of hydrophobia were reported from every part of the country? Do you recollect a single case of the kind in which any attempt, meriting the adjective scientific—nay, any attempt whatever, was made to verify the existence of that dreaded disease and where it really was verified? Allow me to briefly reproduce a few of the cases which were published far and wide, with the deliberate and malicious purpose of causing a sensation. I will show you later that the result was the production of imaginary disease, real alarm, real suffering, and something else, which was but too real:—Death!

On Ninth avenue a horse was seized with some nervous symptoms. It was reported that the animal had been bitten by a dog. There was some contradiction on this head, but it made no difference. An alarming announcement of an outbreak of hydrophobia in this city was published in the largest possible type. The ink was scarcely dry, before a competent veterinarian decided that the horse was suffering from an ordinary equine disease, known as cerebro-spinal meningitis. Another epidemic was next announced from Ironton, with this heading: "The Mad Dog Scare; Citizens Arousing Themselves." The nucleus for this report was a fit occuring in a little dog, due to his having swallowed more chicken bones than he could digest, and this the autopsy showed. An epidemic of hydrophobia was also reported from Southern Illinois; several persons were represented as having died. The Ninth report of the Illinois State Board of Health, in speaking of this epidemic embodies the conclusion that it was spurious, and to show this cites the following instance in point. Wm Bundschuh, of Unith, Alexander County, was severely bitten a year ago, by a dog who was summarily executed. The wound healed very slowly, and the patient lived in a dread of hydrophobia which was greatly increased when a certain newspaper furnished column after column of Pasteur's pronunciamentos. About November, last, he became afflicted with fever, had convulsions, and was pronounced hydrophobic, by a physician who duly chloroformed him. The patient's brother-in-law calling in Dr. Royal, of Villa Ridge, the latter discovered that it was a case of severe intermittent fever, and under appropriate treatment, succeeded in masterboth the real and the imaginary affection, and thus saved Bundschuh's life.

A similar case of spurious hydrophobia, occured in the practice of Dr. Feeny, of Staten Island. The patient was firmly told that he had an ordinary form of delirium, and ultimately recovered. I believe if this patient or his Illinois fellow-sufferer had been starved, chloroformed and terrified, the verdict would have been "died from the bite of a mad dog." You are all acquainted with at least a part of the history of the so-called Newark epidemic. Out of the mass of imperfectly collected testimony, the following facts may be regarded as approximately true: A dog had bitten a number of other dogs as well as six children. The transgressor was killed, in accordance with the time-honored custom of hanging such criminals first, and trying them afterwards. Four of the children were sent to Pasteur, two remained in Newark, and Mr. Runge, a sensible veterinarian, had the bitten dogs locked up where they could do no harm on the one hand, but on the other, where it could be determined whether they really had been inoculated with hydrophobia. After keeping these dogs under careful daily observation for four months, Mr. Runge discharged them from custody as "not guilty." Meanwhile, the Pasteurized children returned from Paris, to figure in a dime museum, and to such extent as they constituted a source of income to their parents, were better off than those which were not Pasteurized. The latter, however, were of far greater value to scientific men, than the four who were exposed to the gaze of morbid sight-seers. They also remained free from hydrophobia, and showed, that in this case at least, the alarm had been a false one, and that a great deal of public anxiety had been wantonly provoked, and philanthropic gush as fruitlessly expended. Had this agitation no worse results in Newark? What did the pound-keeper, George Neall die of? I am aware that able and learned colleagues pronounced him to be suffering from hydrophobia. I do not intend to widen the scope of this paper by taking up the views of those who deny the existence of such a disease in the human being. I simply take the account as I find it. It seems that for several days, that is, during the entire time of his illness, Neall obtained no drink, and ate nothing except an apple. He received hypodermic injections of chloral, atropin, and, had he lived longer, curare, cocaine and vapor baths would have been tried, That he was under the dominion of a terrible fear, is evident from the fact that *he got up shortly before his death, walked into the kitchen, placed his hand in a pail of water and had a spasm in consequence, which lasted half an hour.* Were starvation, depressing neurotic medicines, and terror, without an effect on this patient's vitality?

I received the following interesting and valuable account of the Arlington case from Dr. J. A. Exton, President of the Hudson County Medical Society.

Willie Klee, aet 10, an inmate of the Sacred Heart Industrial School was bitten by a dog which was chained January 17th, in the City of Paterson, N. J., while home on a vacation. He returned to the Industrial School January 18th, and was to all appearances in his usual health.

January 22d, he was with the others of the institution successfully vaccinated, notwithstanding his arm bore evidence of former successful vaccination. January 23d, he was sent to bed by the sisters because he had *fits*. In giving me a history of the case, they said he would growl and bite, or make attempts to do so; that saliva would flow from his mouth and that he seemed in constant fear that some one was going to harm him. January 24th, I saw him at one o'clock, he looked bright and intelligent, pulse 72, temperature normal. The sisters in charge said he had passed a comfortable night after having taken 10 grains Potass Bromid. but that at five in the morning, when the bell was sounded, he immediately went into a convulsion which lasted some five minutes, during which he growled and barked, etc.

Desiring to get more knowledge upon the case I ordered the bell to be sounded. The lad was napping when this was done, and immediately he slowly raised himself in the bed, snapped, barked audibly many times, growled, clutched the covers spasmodically and hid his head and moaned, the arms and legs remaining fixed. I allowed him to sleep some time, when I carefully roused him, and taking some water turned it from one glass to another in front of him, and purposely dropping some upon him. This caused no seizure. and upon suggesting to drink some, he consented and drank with a relish. I ordered him a vapor bath to be continued twenty to thirty minutes, before beginning which he was to have ½ ʒ Fl. Extract Jaborandi, this dose to be repeated every half hour until three were taken. After coming from the bath he was to have and did have one teaspoonful of the following

℞ Potass Bromid.
Hydrat Chloral aa ʒid.
Aqua P—ʒii.

M. Sig. Coch 1 in water or syrup every three hours unless asleep, and all noises which were thought to annoy him carefully discontinued.

Upon my visit next day the boy was perfectly quiet and had been so since coming from the vapor bath.

The bell, which on the previous day caused a seizure, was again tried, but to no purpose. He had eaten properly and without the least difficulty of deglutition and was in every way, so far as I could see, himself again.

The Jaborandi of course caused free salivation, which fixed the case in the minds of the attendants as one of Rabies.

Question ? Was this Hydrophobia or was it Hysteria.

The great influence which expectant attention has in provoking peculiar sensations, even in calm and courageous persons, is illustrated in the case of J—— C——, of Watertown, now under the treatment of my friend, Dr. J. D. Spencer. In this case, the patient, if not a disbeliever in hydrophobia, was like his physician convinced that the vast majority of cases in man were of hysterical origin. I quote his own statement, as made in response to the question, what medical treatment had been instituted in his case?*

"What has been my treatment ? Dr. Spencer must tell you that. I have followed his advice and taken his medicine ; have kept cool and calm ; saw no one but the doctor for 11 days. My symptoms have been carefully noted down, sometimes by myself and sometimes by my wife. I noticed alarm in the doctor's face the eighth day. My temperature was normal and my pulse 120. I calmed myself as best I could. That morning I began to have sharp pains in my eyes. The eyeballs enlarged so that I could see to read nonpareil without glasses, something that I had not done for twelve years. There was an uneasy restlessness all day. Although my temper is usually calm, it was with the utmost endeavor that I could control myself. I wanted to scold or hit somebody, and chewed up a whole lead pencil in my fury. I retired between 7 and 8 in the evening, not because I was sleepy, but for the purpose of getting out of the way of everybody. Hot and cold flashes passed through my system until midnight, while I tossed and tumbled about the bed wrapped in flannel sheets. With almost lightning suddenness then began pains, sharp ones, seemingly coming from the wound at first, but so rapid that within a short time they seemed to start from every part of my system. I was burning, in pain, and thirsty. My first impulse was to take a run in the cool air, my second was to stay in bed and fight it out. I did not care to call any one, fearing that their talk would cause me to lose what little reason I had. I felt so light that it seemed to me there was danger of my floating out of bed; I firmly grasped the side of the bed and held on, believing the unusual pain and heat would soon pass away. I held myself in that position until a few minutes before 4—nearly four hours—when the pain and heat suddenly stopped. My mind was perfectly clear. The flannel sheets were wet with perspiration, I got up terribly exhausted and attempted to take a teaspoonful of aromatic spirits of ammonia in half a glass of water which had been prepared for me to drink through the night. My stomach repelled it with terrible force. I waited until the stomach had quieted down, and then I swallowed the medicine quickly, shutting my mouth with a grim determination that it should not come out. The stomach acted the same as before, but I would not open my mouth. It was hard, and my throat did not feel just right. Well, I got it down, and got such a terrible wrenching that I have not yet recovered. I took my medicine next day with my eyes closed. There were some of the symptoms of the night before, but they were lighter, and have now passed away entirely—at least, I think so. I could easily have gone crazy had not I kept my senses when burning with pain and thirst; would probably have done so had not Dr. Spencer sent me home from the office to remain quiet. I have a sore leg, and just as soon as that is healed I will be at work again, satisfied that there is as much hydrophobia in a person's mind as in a dog's bite, and believing that our best American physicians can cure what disease there is if patients will only control themselves and not go off into hysterics.

**New York Times* of June 2, 1886.

I believe no one here, whatever apprehension he might entertain as to the future prospects of this case, would call the symptoms of Mr. C—— above detailed, symptoms of hydrophobia.

Dogs become mad; insane, in other words, as men do, from various causes and in various ways. I had hoped to exhibit an insane cat, to-night, the pet of a friend, which had been shot in the head, and which, fortunately did not run across the path of any "alarmist." In Japan, as Prof. Law informs us, the boys produce what is supposed to be rabies, and indeed resembles traditional rabies in every respect, by administering to dogs a fungus,* which grows on pine trees. So great is the resemblance of the counterfeit to the original, that the dogs are killed by way of precaution, and it is claimed that the artificial affection can be transmitted by the bite. If that be true, it is fortunate that the human being is not a biting animal, for they have the habit in Siberia of drinking a decoction of a fungus which produces intoxication, and sometimes delirium. When the fungus is scarce the urine of those intoxicated is consumed by others desirous of participating in the same enjoyment with the aristocratic first imbiber of the *muscarin*. As yet we have had no opportunity of learning whether the latter might not confer a share of his pleasures through biting his poorer fellow consumers.

On the 4th of February, William Higgins shot himself from fear of hydrophobia. He had been bitten by a dog six months before. The Sunday before his death, while he was on a visit to his sister in Sixth street, he said he had carefully studied the preliminary symptoms of the disease from the papers and he detected them in himself, and told her not to be alarmed if she heard of his death. †

The following horrible case, I submit in the original language of the report; it requires no comment:

> "Cohoes, N. Y., February 3d.‡—Sunday night George Waterhouse, aged 14, was taken ill and showed signs of hydrophobia He grew rapidly worse, and last night was in such a suffering condition, with eyes protruding and mouth frothing, that the physicians saw there was no hope of saving him, and to end his sufferings *ordered that he be smothered*, which was done. Waterhouse was bitten by a dog *six years* ago, while a resident of Lansingburg. The wound healed rapidly at the time and caused no inconvenience until now."

I believe the number of persons dying of so called hydrophobia almost simultaneously with the agitation of the subject of Pasteur's methods, but who had been bitten between nine months and nine years previous will be found to reach a hundred or more.*

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* Bukeryo, according to a communication from his student. Mr. Sâzé. (*Pepper's System of Medicine by American Authors*, vol. I., p. 891).

† *New York World*, February 5, 1886.

‡ Probably the *Times* correspondence of February 4th, 1886, the scrap is unfortunately not marked.

Let us see what one of the leading American comparative pathologists says regarding such occurrences:

> "But all such cases of prolonged incubation in man are at the least extremely doubtful. Man often contracts a pseudo hydrophobia as the result of fear, and is curable by moral suasion only; and as no such protracted incubations are noticed in the lower animals, and as no one of these abnormally deferred attacks in man has been verified by successful innoculations on animals, it is prudent to reserve a full assent until they are supported by better testimony. A specimen of such cases is that recorded by Chirac, in which a cadet bitten at Montpelier, afterwards spent ten years in Holland, and then, returning and hearing that his fellow-cadet, bitten by the same dog, had died of hydrophobia, he also manifested the disease and died"

The ablest review which has yet been made of the subject of spurious hydrophobia is by Dulles, of Philadelphia. He shows that this condition may result from 1. Disorders of the stomach, especially in very young children, as well as from inflammation of the œsophagus and stomach in adults.*† 2. Disorders of the respiratory apparatus. Their resemblance in many of their symptoms is so great that, in 1625, Aromatarius devoted a monograph to proving that hydrophobia is nothing

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*Case by Dujardin-Beaumetz (*British Medical Journal* letter of January 15th, 1886).—The patient had been bitten in the right hand, in 1884, by a dog *that did not seem to labor under any rabic symptoms*, but was nevertheless killed. The doctor—I say, most unwisely!—expressed a fear of hydrophobia on the patient's complaining of pain at the site of the wound on November 1st, 1885. The sequel can be imagined. Pasteur as usnal made a theatrical declamation, "I can preserve, but I do not cure," and the patient then expired in terrible agony. A Major Morley died about the same time at Malta. twelve months after a bite from his own dog, which is said to have been seized with rabies at Dover.

† Disorders mistaken for Hydrophobia. Transactions of the Medical Society of the State of Pennsylvania for 1884.

‡ He cites Prichard's description of so called intestinal mania as follows: "The mouth and fauces if examined, generally present a diseased aspect. The fauces and velum penduium are red; the vessels injected covered in patches with mucus. . . . . The mouth is viscid, and the patient generally spits out a frothy slime in all directions. . . . . There is an ardent thirst. , . . . In many cases the patient has an aversion to all food. . . . . The skin is clammy and cold. . . . . The complexion is often flushed, the eyes wild, glassy, with a superabundant lachrymal secretion, the tunica conjunctiva is not unfrequently injected with blood, the patient is scarcely tolerant of light, ... The urine is scanty and high-colored. . . . . The pulse is rapid and irritable."

but a contagious sore throat.* 3. Disorders of the circulatory apparatus: that inflammatory conditions of the heart and its coverings give rise to the spmptoms of hydrophobia is a fact well recognized in most treatises and special articles on the subject. 4. Systemic conditions: such are rheumatic fever, gout (H. Sutton), uraemia, intermittent fever, mercurialization† and pregnancy.‡ 5. Disorders of the nervous system: meningitis, pachymeningitis, tumors and parasites of the brain, simple neuritis, acute mania, deliria, § alcoholism, tetanus, epileptic delirium, hysteria, and narcotic poisoning.

I am able to add three instances to those collected by Dr. Dulles, where symptoms commonly or erroneously regarded as hydrophobia were present. The first of these was a case I saw in Williamsburgh with Dr. Fuhs. I published it in the *New York Medical Record.*‖ It was one of epileptic delirium, in which the patient snapped continually at everything about him with an appearance of grim ferocity, and developed terrible laryngeal spasms with growling noises in addition. I remember, as Dr. Fuhs accompanied me a short distance in the street, his saying: "Many a hydrophobia scare has been started on a less sufficient basis"—and he was right. The second case I saw through the courtesy of Dr. T. A. McBride. While walking through the wards of the Presbyterian Hospital he was notified that a man had arrived with the diagnosis of hydrophobia. He was in a close apartment; as I walked in at Dr. M's invitation, the mouse-nest odor of typhus fever was apparent; as the physician lifted up the patient's clothing a beautiful exanthema was displayed. In his delirium the poor fellow had spoken of dogs,* and his medical attendant had thence made the diagnosis of hydrophobia. It was stated to me later that the autopsy revealed the existence of epidemic meningitis. The third case I cite from a foreign journal.† In this case, one of disseminated sclerosis, described by Pollak, there was a remarkable horror of water. The patient, a weak-minded child, suffered from polyuria, yet it was impossible to get it to take water, and almost impossible to force down a few drops of other liquids, such as wine, beef tea, or lemonade. Even when it made efforts to swallow them, they were regurgitated convulsively, the entire body being agitated by tremors. Finally the mere sight of these fluids caused it the greatest distress. For fourteen months this singular dread of fluids continued; at the end of that time the child died. The reporter of this interesting case attributes the hydrophobia to the sclerotic changes which were found in the oblongata.

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* Dulles sustains this view for some cases, "although by a strange process of inversion the striking inflammatory lesions which have been found in them *post mortem* have been looked upon as effects, when, in fact, they were really causes." He cites a case reported by Vidal, where undoubted laryngitis was mistaken for hydrophobia.

† Dr. Reid, in 1817, mentions a young woman dying of hydrophobia caused by mercury taken for syphilis. It was really a case of ulcerative stomatitis.

‡ Mazars de Cazelles saw hydrophobia occurring eleven times during the first four months of pregnancy in the same woman. Doleris mentions a like occurrence.

§ Westphal (*Archiv fur Psychiatrie II.*, p. 520) says that acute delirium is often confounded with hydrophobia, and that, in depressed and hypochondrical subjects, the bite of a healthy dog will cause hydrophobia

‖ The aspect of the patient was truly horrible, with a ghastly grin he opened and shut his jaws with such intensity that one feared his teeth must crack; at the same time he tried to catch the hands of those restraining him with his jaws, and, actually—although in epileptic unconsciousness—attempted to discover where these hands were, by using his tongue as a feeler. When his tongue felt a hand, his jaws would snap at it. His eyes rolled, the pupils were widely dilated, and he caught at his (contracted) protruding larynx with such a vigorous clutch, that, had he not been prevented, he would have torn it out.

The resemblance between the spurious hydrophobia and the so-called real affection is so great that I cannot criticise anyone for believing, with Dulles, that the existence of a genuine hydrophobia in man is not proven. In order to avoid citing *ex parte* evidence, I subjoin some extracts from "Pepper's System of Medicine by American Authors," the particular author being a believer in the reality of hydrophobia:

> "The languor fever and nervousness attendant in extreme heat tend not

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* Dogs play a prominent part in the delusions of the insane. Kiernan, who has made several contributions to the subject of spurious hydrophobia (*Am. Journal of Neurology and Psychiatry*, May, 1883), mentions a Katatonic patient, who was "followed to church by droves of dogs."

†Congenitale, multiple Herdsclerose des Central-nervensystems; partieller Balkenmangel von Doctor Ladislaus Pollak.—*Archiv fur Psychiatrie XII.*, p. 157. (Congenital multiple sclerosis, in foci, with partial defect of the corpus callosum).

only to hasten the activity of any disease-germs actually present in the system; but also strongly favor the increase of that nervous fear which *so often generates a fatal pseudo-hydrophobia* (lyssophobia) *in persons that have been bitten by dogs*."*

† "The most difficult to distinguish from the genuine disease are those cases in which hydrophobia occurs as a disease of the imagination, the result of fear—the lyssophobia or *hydrophobie non-rabique* of the writers. In these there is always the history of a bite, the cicatrix even may have become the seat of congestive redness, itching or neuralgic pains, and these, acting on a susceptible brain, develop a disease which is hardly distinguishable from true hydrophobia, and which is quite as fatal if left to run its course. These cases have usually less reflex susceptibility than genuine hydrophobia; the attack mostly occurs shortly after some conversation on the subject, and especially about the effects of the bites on others, and the victim is seen to have a nervous organization, and may even be known to have been subject to hysteria or other nervous disorders. *At the same time, the concentration of the mind on this subject sometimes produces even structural changes in the medulla.*‡ and the reflex susceptibility in co-ordination with the other symptoms may be *almost perfect*. In a case reported a few years ago, by Hammond, the symptoms appeared perfectly characteristic, and at the necropsy, circumscribed points of congestion were found near the roots of the vagus; yet the dog that bit this man was said to be alive and well, and in the absence of any successful inoculation from biter or bitten, the case must be presumed to have been lyssophobia."

"Many cases with a more favorable issue are recorded. Bellenger had a patient who had been bitten by his cat, and manifested violent paroxysms of hydrophobia, but was instantly cured by the sight of the animal in good health. Brouardel records that a man was bitten by his dog which afterwards disappeared. He was seized with severe hydrophobia which continued for two days: when the lost dog was found and presented to him the symptoms disappeared. Trousseau speaks of a magistrate whose hand had been licked by his hound, which immediately after attacked a flock of sheep, so that many of them died of rabies. The master then manifested hydrophobia, but as death was deferred beyond the usual time he concluded it was not genuine and recovered. Prof. Dick was called to visit a man who had been bitten by a favorite dog, which, while suffering from distemper, had manifested severe hydrophobic symptoms, and had been given up by the attending physicians. He succeeded in convincing the subject that as the dog had had distemper, and as no two great diseases could exist in the same system, it could not have had rabies. In spite of the false premises, this reasoning had the desired effect, and the patient recovered. A few years ago a boy twelve years old, in Ithaca, N. Y., was bitten by a dog supposed to be rabid, and in due time manifested hydrophobia, which advanced rapidly, until he was having a violent paroxysm every half hour, and it was pronounced impossible for him to survive another day. At this time I saw him, observed that he had a nervous organization, and was somewhat lacking in the hyperaesthesia of rabies. Learned that he had recently been gorging himself with christmas delicacies, and was now very costive, and as there was no satisfactory history af the dog, I at once suspected lyssophobia. The friends and strangers who had come to condole with the parents, and feast on the horror were excluded, and the boy's attention fully engaged in amusing pictures and conversation; the paroxysms were omitted, and, in two hours, the patient overcome by weariness, went to sleep. Next morning, he was still kept secluded and quiet, and two enthusiastic students took up the rôle of keeping his attention constantly engaged on whatever would interest him. The prima viæ was relieved by medicine, and under a course of tonics he quickly recruited, and, at the end of the week, went back to school."

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*Op cit, p. 888.

† Op. cit. p. 901.

‡ Law states no authority, or special observation to justify the statement beyond the case mentioned.

A case occurred in this city, a few weeks ago, which illustrates how a little good sense on the part of a physician may avert a calamity in the same manner so happily effected by Professor Law. A boy of thirteen had harnessed his own and another large dog to a boy's cart. The reins got entangled and the dogs quarreled. The boy went to the assistance of his own dog and was snapped at by the antagonist. He thought little of it, but the boys on the street told him he was doomed to die of hydrophobia. Some grown up—not inmates of a lunatic asylum—but fellow-citizens entitled to vote, joined in this verdict, and the poor boy came home with a face as white as chalk, kissed his mother good-bye, and saying he had to die, disposed of his little possessions. The family physician was called in at about eight o'clock. Instead of pooh-poohing the matter, which, though justifiable, would not have effected his purpose so well, he said: "Well, my boy, I see how it is, you are going through a crisis. If you survive nine o'clock this evening, you are positively safe." The child's attention was thus fixed upon the minute-hand of the clock, after it passed the critical point no more was heard of hydrophobia in *that* house. I cannot suppress the wish that some of the $1000 checks which are flying around in Paris, just now, might drop into the lap of such men as these, who save life, not with loud fan-farronades about microbes (whose existence has not yet been proved), nor who destroy life by creating spurious epidemics through fear and terror, but, who follow out the sensible course, dictated by the knowledge and sympathy of the true physician.

I am aware that a certain philistinism is more or less rampant, just now, in medical literature, which is opposed to every form of criticism. There are minds so organized that they cannot conceive of a man calling attention to the errors of another, unless he have a personal motive. And should one be in the unfortunate position of having played the critic on more than a single occasion, he is accused of having a mania for antagonizing people. Those who are notorious for anonymous attacks on and misrepresentations of their colleagues in the editorial columns of certain medical journals, which seem to have taken the political journal for their model, are often the loudest in denunciation of those who have a sufficient courage of opinion to make their strictures over their signature, and not under the disguise of an editorial inuendoe. I firmly believe that he, who through accident or other means, is in a position to calm public apprehension, has a duty to perform, even at the risk of inviting such criticism as that referred to.

A "Pasteur Institute" has been organized in this city, and is now ready to receive contributions. I believe I am doing that institution no injustice when I say that the more hydrophobia scare can be created in the community, the better it will flourish. It rests for the present on two foundations: First, on a rabbit brought over from Paris, which had been inoculated by Pasteur, and which died on the way over, or shortly after its arrival. Second, on the allegation that genuine hydrophobia now exists in and near New York City. About the defunct rabbit there is very little to be said; about the alleged existence of hydrophobia, a great deal. In so far as one of the incorporators of the Pasteur institute has contributed to the public alarm on this question, by the published autopsy on one dog, and of an experiment on another, I propose to present for your consideration, not theories, not doubts, not guesses, but facts, which, I believe, will not be gainsaid by any of my medical friends. In so far as I have found it necessary to adduce observations of my own, I do not ask you to accept my bare word for them, but I have brought the very animals to which these observations relate before you. The brains of one or two of them will be removed, and you can examine both the living and the dead subjects, and test the correctness of my conclusions by the aid of the indisputable evidence of your own eyes. Dr. Liautard's experiment is thus stated:

The *Herald* is enabled to give the result of the first successful experiment made in this country according to the Pasteur method, by which undoubted rabies in a dog has been determined. The experiment was brought about by the bite which Miss Morosini received from one of her dogs last month, an event which has already been recorded in the *Herald*. The dog was a household pet and had not previously exhibited any symptoms of rabies. It was killed immediately after it had bitten Miss Morosini, but not before it had bitten several other dogs.

Mr. Morosini was averse to sending his daughter to Paris for treatment by M. Pasteur. At Riverdale it would not be believed that the dog was mad. But Dr. L. D. Buckley, of this city, was promptly communicated with, and he as promptly notified A. F. Liautard. M. D. and V. S. of the American Veterinary College in West Fifty-fourth street. Both gentlemen advised that Miss Morosini should go to Paris at once to see M. Pasteur. Dr. Buckley lost no time in securing the carcass of the dog that had bitten the young lady and sent it to Dr. Liautard. At the Veterinary College a post-mortem was held on the dog, and an experiment made on a living animal by inoculating it with the supposed virus of the dead dog.

A *Herald* reporter yesterday called at the Veterinary College and asked Dr. Liautard, under whose supervision the experiment was made, to make known the results. Dr. Liautard had written a report of the case for the June number of the *American Veterinary Review*, and from the advanced sheets the reporter was kindly permitted to cull the following facts :

Miss Morosini was bitten on April 14. The dog was killed almost at once, and on the same day was sent to the Veterinary College of which Dr. Liautard is chief surgeon. Dr. Buckley requested that a post-mortem should be made as early as convenient, as it was a matter of the greatest importance. The post-mortem was begun without delay, and there were revealed important lesions, congestion of the fauces, empty condition of the intestinal tract which was slightly congested, stomach containing one large bird feather, the kidneys somewhat congested and the bladder empty and retracted and somewhat congested.

"These symptoms were considered sufficient evidence, with the history of the case, to justify a diagnosis of rabies. A report to that effect was made to Dr. Buckley, and it was urgently advised by Dr. Liautard that the injured young lady should as early as possible, go to Paris and place herself under M. Pasteur for treatment. Then it was decided at once to try the cerebral inoculation as carried out by M. Pasteur to confirm the diagnosis.

"The brain and medulla oblongata of the dog having been carefully kept, another dog was secured for inoculation on the following morning. After placing the dog under complete anæsthesia the cranium was trephined a little on one side of the median line. The dura mater was then carefully divided and a little of the medulla of the first dog placed over the cerebrum of the second. The edges were brought together by sutures protected by wadding and collodion, and the animal was placed in a secured kennel for observation. He recovered from the anæsthetic, ate well and the wound healed slowly, presenting nothing apparently abnormal. On April 30th, however, the dog appeared to be more affectionate to those who were caring for him, and also to the house surgeon who watched him.

"On May 1, the sixteenth day after the inoculation, the patient showed the first symptoms of dumb rabies—that is, paralysis of the lower jaw. The mouth was slightly open, the jaw hung down, and abundant saliva flowed from the mouth. Still the dog was very affectionate. The next day the lower jaw became more paralyzed. The animal was weak and tottered in his gait. Paraplegia (or paralysis of both hind legs) now showed itself. His sleep seemed disturbed, his tongue hung from his mouth and he showed no desire to bite. In fact, all the well-known symptoms of rabies were clearly present.

"The diagnosis made at the post-mortem of the first dog, (the one that bit Miss Morisini) was thus confirmed by this experiment and reaffirmed by the post-mortem of the second animal, which died during the night of the 8d. At this autopsy the following lesions were found :—Pharynx highly congested and containing considerable foreign matter, such as hay and straw, the stomach also highly congested. In it were found the same foreign substances seen in the pharynx; the intestines were empty; the bladder empty and firmly retracted in the pelvic cavity."

As the young lady had left New York only on April 22d, and as she could scarcely be expected to reach Paris much before the 2d or 3d of May, there was no time for her to lose in beginning her treatment. Accordingly when the symptoms were sufficiently marked, very early on May 3d, a cablegram was was sent by Dr. Liautard to M. Pasteur, informing him of the result obtained; and on the 5th a cablegram from Europe gave the information that Miss Morosini had received the third inoculation on that day.

"We may therefore conclude," said Dr. Liautard, "that the young lady is now all right. But we could not be sure of that had she delayed her journey to Paris till we found out whether or not the dog that bit her had rabies. This shows the importance of having a Pasteur institute on this continent. M. Pasteur says he will not guarantee a cure if the patient delays coming to him after the thirty-sixth day. The sooner the better. Now, in ordinary cases it will happen that a bitten person will linger till it is put beyond a doubt that the dog is mad. That will take at least fifteen days, and it may have been ten more before the test is begun. There are twenty-five days, and it would probably take the person eleven days to get to M. Pasteur. What chance, then, would there be of a cure? Probably none at all. But with an institute in this country such dangerous delays would not be possible.

"Now, in reference to this experiment, it is noteworthy that symptoms of rabies were manifested in the dog experimented on in sixteen days after inoculation. M. Pasteur says that the symptoms are manifested from the fifteenth day up. Is not this very close?"

Dr. Liautard in further conversation seemed to think that it was possible in the future to have a law compelling all owners of dogs to have their animals inoculated for rabies as a preventative, just as vaccination was compulsory.

As far as Dr. Liautard's diagnosis of rabies, in the dog that bit Miss Morosini is concerned, I have to state that as assistant to Professor Henry Draper, the instructor in physiology,

at the N. Y. University, I certainly examined scores of dogs, some of which were purchased from street arabs, and not a few of which I had decoyed within the precincts of the laboratory myself. Not one of the animals showed any sign of rabies. On the contrary, they exhibited that docility and affection, which, under the circumstances, is the most touching characteristic of the animal. There was scarcely one, and, certainly not one young dog, in whose stomach I did not find more or less foreign material, I remember that kite strings, and top pegs were frequent; that coal, ashes, straw, feathers and cotton spools were occasional findings. Shoe leather, pieces of cloth, and, if I remember rightly, a pocket knife, but certainly, some unusual article of metal was found in a pet dog, that had been sent to us owing to the crusade which had been inaugurated against that particular breed just then.*

This became a subject of comment in our laboratory, and I recollect that it was supposed to be a satisfactory solution of the problem that we found intestinal worms in large numbers in those dogs which had the largest and strangest assortment of foreign bodies in their stomachs. A cat which had a similar collection contained three tape worms. The feather in the Riverdale dog, therefore goes for nothing. As to the congested kidneys, congested fauces and empty bladder, I would simply ask you how would the fauces, kidneys and bladder of a man appear, who had been hunted for several hours, by a large crowd, armed with shot-guns and pitchforks?

With regard to the "dumb rabies" which Dr. Liautard thought he had produced in the second dog, every physician familiar with the researches of Schiff, Flourens, Hitzig, Fritsch and Goltz, will recognize in it the ordinary results of experimental and inflammatory disturbance of the brain functions in the dog. According as the irritating injection affects one cortical field or the other, the paralysis will vary, but paraplegia is quite characteristic of meningitis and encephalitis in the dog. In order to show the society that the symptoms of hydrophobia, as Dr. Liautard considers them, can be produced

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*The *N. Y. Herald*, of that or a later date, headed one column for weeks, with such declarations as "Down with the Bloody Spitz!" "The Spitz Doomed!" "The Spitz must Go!" It was supposed that this particular breed was more disposed to become hydrophobic than any other.

in healthy dogs, by introducing non-rabic foreign substances into their skull cavities, I performed experiments on six dogs, in three relays, that I might be certain to have some of them alive to-day.

Experiment A, May 29th.—Mongrel bull dog, was etherized at 1.30, a longitudinal incision made parallel to the median line, the periosteum raised by a crucial incision, the trephine applied, and as the diploe was unusually loose the instrument had to be applied a second time to remove the inner table. Considerable hemorrhage occurred from the diploe, and probably from a meningeal vein, wounded in slitting the dura. An incision one half a centimetre in length was made in the latter, and about six cubic millimetres of the spinal cord of a healthy calf, slaughtered about twenty-eight hours before was introduced on the brain surface. Some hernia cerebri ensued. The wound was united by four sutures, an opening being left for drainage. The operation, including the etherization, lasted about six minutes. The dog was put in a stall, and fifteen minutes later was on his feet and tottering around.

June 2d.—The animal is feeding and drinking, again ; it had not fed for a day or so after the operation. There is a slight droop of the left upper eyelid ; the eyes appear dull. There is manifest paralysis of the hind legs, the tail is sometimes drawn in between them. The disposition of the poor animal is exceedingly friendly, wagging his tail feebly, and crawling forward and fawning as soon as the door is opened. There is considerable fever and the eyes are dull ; there is ptosis. The wound is granulating and discharging healthy pus.

June 5th.—Animal is not feeding so well, less feverish, very much emaciated, the eyes are brighter, the paralysis of the hind legs does not manifest itself in the straddling gait noted a few days ago, but in a sort of wabble. On getting out into the court-yard, the animal began swallowing horse dung and was driven back to its stall in consequence. The wound is not looking so well ; it is dressed with carbolated vaseline.

June 6th.—Disposition to us unchanged, quarrelled over the milk with dog C.

June 9th.—The paraplegie gait is very marked. The animal seems to be acting impulsively at times. It attempted to swallow a dry drum-stick of a fowl. It would have again eaten horse-dung had it not been prevented.

Experiment B.—A second dog, a mongrel spitz, was operated on immediately after the former. A T-shaped incision was made over the right temporal muscle, the periostenum scraped as before, and a button of bone removed. A small opening had been made by the center pin in the dura, and through this some of the same material used in the last experiment was introduced in a comminuted form. There was not much hemorrhage in this case. The wound was closed by sutures, and the animal placed in another stall.

June 2d.—The animal has been doing well; it is kept on low diet; there is a little discharge from the lower angle of the wound of a benign character. It was noted to be rather an aggressive animal before the operation, and had, together with the other dog (A), barked at visitors, and made demonstrations between attack and fawning which all small dogs, particularly of that breed, are apt to make. It is to-day quite a different animal, fawning, wagging its tail, and clings to any one who will give it a friendly word. In running, the hind legs are not quite as steady as the fore legs; in stepping among the round stones with which the court is paved, that lack of skill, so well described by Hitzig, is noticed—the animal sways considerably, and crouches with the hind-quarters, but is able to rise on its hind legs.

June 5th.—There is considerable improvement in motion. The greater part of the day the animal lies on its side, paying no attention to the door when opened, or to those who walk around and close to it. The wound is doing very well.

June 9th.—The paraplegia is more marked; the animal is unable to jump down a distance of one or two feet, but lets itself down on the fore-feet and then slides down with the rest of its body. It has undergone an entire change in demeanor, being shy, avoiding visitors, and instead of coming when called, as it did June 5th, crouching and concealing itself. At the same time, the animal appears apathetic.

Experiment C, June 2.—A large mongrel black-and-tan etherized, terebration performed to the right of the median-line about one inch. The instrument being defective wounded the brain, and some brain matter was found adhering to it. A hypodermic needle was then introduced through the opening and twenty drops of an emulsion of a calf's cord slowly injected into the brain wound. Some of this escaped. The animal was allowed to recover in a stall. The slight opening in the skin was not sutured.

June 5th.—The wound is scarcely noticeable. The animal is very feeble in its limbs, although in good general health. It can scarcely step sideways without going down on the hind legs, and a slight ataxia is noted in the fore. Both paralytic and ataxic symptoms appear more marked on the left side. The animal appears to be stupid and dull.

June 6th.—The same feebleness in the hind limbs is noted in a marked degree. The animal seems a little brighter

June 9th.—The animal is very stupid; runs against objects; does not avoid obstacles, and exhibits decided *manège* movement, running in circles to the right. On being roused, when lying down, which is the animal's usual position, it rolls over and frequently slips with its hind legs which tremble a great deal. At night this dog howls a great deal, and growls at people entering the court at all times. There is a question as to whether it is able to see well; but owing to its stupidity, it is difficult to settle this point satisfactorily.

Experiment D.—Mongrel collie of a vicious disposition, same operation as in C, an emulsion was prepared from the pons and cerebellum of a gentleman who died of hydrophobia on May 14th, and whose brain and cervical cord I obtained through the courtesy of Dr. Paul H. Kretschmar, of Brooklyn. This was injected into the parietal region of the brain, and—by calculation—into the thalamo crural region. While the animal was being placed in the stall he managed to escape the attendant, and ran around, avoiding those who attempted to block his passage or catch him with considerable skill. He seemed to be acting under some impulse which kept him "on the go." This dog acted differently from the others under the ether, and his cursorial exhibition was, probably, but the result of intoxication; it closely resembled, however, the result of experimental irritation of the so-called cursorial center in rabbits as described by Nothnagel.

June 5th.—This animal has been "on the go" ever since, but gradually becoming quieter. It runs around actively; there is a little ataxia of the hind legs, and when it runs up to a bar it comes to a halt, appears puzzled, but although gross motor power is unimpaired it neither passes over nor under it, but goes back and around, contrary to its previous habit.

June 6th.—Lies in a corner of the stall with its head hidden in a crevice, and growls and snarls viciously as I enter the stall. On being taken out and tied it makes no effort to bite the stable help, but flies at me and barks furiously. Dr. Hamill found no difficulty in controlling it. There is some question as to whether there is some weakness of the hind-quarters. It is, to-day, the liveliest of the four dogs, and feeds best.

June 9th.—It is not as savage to-day, the pupils are very narrow and the expression appears dull. The sexual instinct is manifested unmistakably to-day.

The emulsion injected into this dog's brain, which was injured in the same place, and to the same extent as that of experiment C, consisted of human material preserved in glycerin and salt, of human material dried and of brain from a rabbit which had been innoculated with the above when fresh, but died on the eighth day from *fungus cerebri.*

Experiment E.—Large yellow dog etherized, trephined; a slit made in the dura, and a piece of common yellow soap of the size of fifteen cubic millimetres introduced between the dura and pia. There was considerable hemorrhage from the diploe, and it was subsequently suspected by one of my assistants that hemorrhage occurred from a superficial artery, whose wound was undiscovered owing to compression during the operation.

June 9th.—Severe constitutional symptoms have been shown by this dog. The jaw droops, and the tongue is often protruded between the teeth. It runs around aimlessly; arrived at a running hydrant, it stands still, as if pensive, but does not drink. There is considerable palsy of the hind quarters, the legs straddling so much that the body nearly touches the ground. There is great sensitiveness of the surface of the body.

Experiment F.—Young mongrel poodle etherized, terebration performed, and ten drops of stale horse's urine injected into the brain substance of the posterior region. This animal had a glandular and suppurating swelling in the inferior nuchal region.

June 9th.—The animal did not eat after the first day following the operation though having recovered nearly entirely from the immediate effects. It became paraplegie, moaned a great deal, and developed inability to swallow, though attempting to drink, yesterday. To-day, at noon, it died. An autopsy showed, singularly enough, no reaction at the site of the injection, but the basilar meninges were filled with a greenish-yellow gelatinous exudation, and the ventricles with a turbid purulent serum. The appearances being those of acute meningitis. When the spinal canal was divided a large amount of purulent serum with floeculi of fibrin ran out. So intense was the distension of the ventricles, that the gyri of the convexity had been pressed nearly flat against the dura, and this against the cranium.

You may decide for yourselves the following:

1. Is there any symptom of hydrophobia related of Dr. Liautard's animal, which is not present in these dogs inoculated with the spinal cord of a calf, with soap and with decayed fluids?
2. Are the mental disturbances resembling those of dumb rabies—so-called—not even much greater in the dogs to-night exhibited than appears in the account of Dr. Liautard's dog?
3. Would it not have been well to have performed such experiments as those whose result you see to-night, at the same time, or before attempting to make of the inoculation of the brain a test of hydrophobia, and alarming the public?
4. Was it in view of the bad effect which the knowledge that the dog who bit a person was mad has on that person's mind, wise to make this announcement in such a shape that it must reach him or her?
5. What reason had Dr. Liautard, or his house surgeon,* for omitting an examination of the brain in the case cited, or—if they made it—for failing to publish its morbid appearances?

I have been thus lengthy in detailing the faulty nature of the evidence on which an epidemic of hydrophobia may be announced, and, in demonstrating that, mere terror and expectant attention, are the chief factors in the spread of the disease, because the practical problem with which preventive legal medicine has to deal is not so much the prevention of a genuine as of a more or less artificial disorder. Inasmuch as the same measures which will check the spread of the real disease—if it exist—will also, and as effectually check the ravages of that terror-psychosis, known as lyssophobia, we may deal with both together.

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* The description in the *N. Y. Herald* is attributed to Dr. Liautard; it is reproduced from advance sheets of the "*American Veterinary Review*," of June, 1886; but these appear under the authorship of James A. Walrath, D.V.S., house surgeon, who opens the article with a becoming reference, as follows: "A dog had bitten Mrs. M——, also biting other dogs, and had been killed, a careful post-mortem examination following, Dr. L's (Liautard's) *expert judgment and his immediate attention* to the case were *urgently solicited.*

The bite of any animal, or even of men, suffering from a febrile disorder, from excitement, tetanus, or from blood-poisoning. is more or less dangerous. Undoubtedly many of the sequalæ of such bites have been summed up under the general caption of hydrophobia.* Whatever theory we adopt, it is the duty of the community to protect its members not only against the more or less venomous bites of such animals, but also against intrinsically harmless bites. Historically speaking, the system of muzzling dogs has been found so efficacious that it is simply surprising that it has not been universally adopted. During the years 1845–1853, inclusive, 278 rabid dogs were entered at the Berlin Veterinary College, an average of about thirty cases a year. In the year 1854, an order for the muzzling of all dogs was rigidly enforced by the police. The result was that in this year, there were but four cases; in each of the two following years, only one case; and in the five years from 1857 to 1861, inclusive, not a single one.† Gibier states that, when in order to pursue the researches for which he received a reward from the French Academy of Medicine, he applied at the Berlin Veterinary School to have a mad dog, he was informed that there had not been a case for three years.‡

The plan of muzzling dogs has been adopted in England. Everything, of course, depends on the manner in which the law is enforced. If, as is only too likely in our own community, the persons entrusted with its execution be selected from the worst class of ruffians, and their pay be made dependent on the number of dogs they can steal from their owners, and the amount of blackmail they can levy through such acts, the public will become disgusted with the law, and those evading it will be supported, instead of being condemned, by public opinion.

Another important precaution which has been almost uniformly neglected on this side of the Atlantic, is the proper observation of suspicious dogs. There is no evidence so good as that obtained from the living subject of rabies. In addition, much suffering, and indeed many deaths might be prevented by the discovery that a dog who has bitten is not mad; and that can be determined with certainty, only by keeping the animal alive.

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* Planat (*Annales Medico Psychologiques*, 1884, p. 383), in all seriousness, publishes a case where a pet epileptic cat bit a husband and wife, who thenceforth became epileptic, as one of transmission by biting! It seems superfluous to say that the microbe (?) of epilepsy has not been described as yet by the most enthusiastic bacteriologist. The case cited proves what nonsense may exist under the garb of science.

† Law, op. cit., p. 890.

British Medical Journal, January, 1886.

The instructions of the Governmental Councillors, in Germany, in regard to autopsies on animals suspected of rabies, read as follows:

> "The contents of the stomach and intestines, and the condition of their mucous membranes are to be determined above all. Then the condition of the spleen, kidneys and liver is to be described. The pharynx, tonsils, trachea, lungs and heart are next to be examined. Along with this the condition of the blood, particularly with regard to its coagulability, is to be carefully noted: finally, the cranium should be opened and the brain examined.

Gscheidlin suggests that this order be so amplified as to direct also the making of inoculations, and, if these cannot be made by the veterinarian in charge, the material to be sent to some designated expert or institution. It is to be understood that only responsible persons be intrusted with such experiments, as animals infected with septic material may do injury if improperly discharged.*

With regard to the recognition of a Pasteur institute as a factor in the legal enactment of measures to prevent hydrophobia, I find language in one of the leading medical periodicals of the world, which so thoroughly voices my own opinion that I cannot do better than cite it.

> †"Attention has been repeatedly directed in this journal to the fact that the method of Pasteur can not be unreservedly accepted as an established one, and that the foundation of Pasteur Institutes is premature until the method of preventive inoculation be placed on an absolutely fixed basis, which in view of the large number of experiments on animals, and inoculations made daily, in Pasteur's laboratory, will presumably be effected in a not unduly remote period. It were high time, indeed, that we left behind us the stage of newspaper reports, which for some months have furnished nothing new be-

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* It was stated in the daily papers that a person had been bitten by a hydrophobic rat. which a medical student had inoculated. But possibly, as he was reported to have resorted to the Mecca of all true and false hydrophobia believers, this case may have been manufactured out of the same cloth as the lessons which Duke Charles, of Bavaria *never intended* to take of Pasteur, and the Commission which the Austrian Government did *not* send!

† Guttman in *Deutsche Medizinische Wochenschrift*, April 29th, 1886, p. 203.

yond the daily increasing number of those inoculated, and the deaths, and replaced the present monopolization of the matter by the cooperation and critical proof tests of competent investigators."

In concluding these remarks, I have a task of gratitude to perform in acknowledging my indebtedness to those, without whose aid, these experiments would have been impossible. Dr. James Hamill placed the veterinary infirmary of Atcheson & Hamill at my disposal, and supplied me not only with abundant material, but made a number of observations in my absence, which completed my records. To our fellow members, Drs. N. E. Brill, F. H. McGuire, and R. Mollenhauer, I am likewise indebted for assistance rendered in the necessary operations.

ART. XIV.—THE EFFECTS OF LIGHTNING, FIRE, SMOKE AND STEAM UPON ANIMALS.

BY THOMAS WALLEY, M.R.C.V.S., PRINCIPAL ROYAL (DICK) VETERINARY COLLEGE, EDINBURGH.

There is, probably, no subject of more varied interest to the veterinary surgeon than the above; there is certainly no veterinary medical subject upon which so little attention has been bestowed. It is not my intention to enter, in this article, upon the discussion of theoretical or new points, but rather to deal with the practical aspect of the question, and to give to the profession the lessons I have learned by practical experience.

LIGHTNING.

THE EFFECTS OF LIGHTNING upon the animal frame are practically those of electricity, and are dependent upon the intensity of the electric current. These effects may be divided into *immediate* and *remote*. If the intensity of the electric current is sufficiently great, DEATH BY SHOCK is the immediate result. If it is of less intensity, death also results; but much less quickly, and from GENERAL OR CARDIAC ASTHENIA, and in consequence of the effects of the electricity upon the great nerve centers. In the former case, there is sudden and total abolition of nerve function; in the latter, there is inability to rally from the primary effects of the nervous shock, and in addition, grave changes are produced in the vital properties of the blood.

While the effects above mentioned are, ordinarily, those of exposure to the influence of lightning, it is not uncommon to find that animals pass through the ordeal unscathed and unscarred; or, at the most, suffer from TEMPORARY BLINDNESS from the effects of the intense glare upon the retinal expansion of the optic nerve. The AMAUROSIS so produced occasionally becomes permanent, owing to the continued paralysis of the nerve.

The remote effects upon the nervous system and consequently upon the muscular are PARESIS and MOTOR PARALYSIS; the former may affect particular muscles or sets of muscles, as for example, one of the labial or facial; while in the latter case NEMIPLIGIA, or PARAPLEGIA may result.

In some instances, grave cutanio muscular lesions are produced; the skin and subjacent structures either being destroyed chemically, or actually lacerated; resulting, if the animal survives, in extensive *sloughing*. This being so great in some cases as to produce death by secondary exhaustion.

The post-mortem evidences of lightning stroke are by no means constant, nor are they in all cases satisfactory, and it often happens that the veterinary surgeon, when called upon by insurance companies to make post-mortem examinations of animals supposed to have died from the effects of lightning, has to trust mainly to *negative* and *collateral evidence* to enable him to arrive at a just and correct decision. Negatively, there will be an entire absence of any lesion sufficient to account for death, and, at the same time, proof may be forthcoming that the animal or animals had been noticed a short time prior to death in a state of perfect health, and that, in the interim, a thunder storm had passed over the district.

Collateral evidence is, as a rule, more satisfactory than negative,—it is to be found in the surroundings of the victim or victims. Thus, if the animal has been sheltering behind a hedge, the bushes comprising the latter will bear evidence of the lightning flash in the form of scorched leaves and branches, or, if the hedge bottom be very dry, it may afford evidence of recent ignition. The banks, too, are often ploughed up and torn into furrows by the electric fluid, while leaves, torn from their branches, and twigs of trees or bushes will be found scattered about the surrounding turf or soil. When shelter has been sought under a tree, indubitable evidence of the action of the electric fluid—in the shape of splintered limbs and branches, torn-up bark, and even roots—is afforded; while the victim (and this holds good no matter how many animals there may have grouped together) is found with its head lying in close proximity to the tree trunk.

In the case of a shod horse—even if standing in an open field when struck—one or more shoes may be found torn from the feet, and the iron itself fused or distinctly magnetized. The carcasses of animals have also been observed to be magnetized by the action of the electric current.

The more positive signs of death by lightning are to be found on the exterior of the body and in the condition of the blood, the muscles, and some of the internal organs. On the skin, the course of the electric fluid can often be traced without the slightest difficulty; the hair, in hairy animals, being scorched in zig-zag lines, commencing often at the shoulder or neck and running down to the foot (as if attracted, in the shod-horse, by the metal of the shoe) and into the earth.

In the sheep, the external evidence is much less prominent than it is in the ox or the horse. Wool is apparently a non-conductor of electricity, and I am led from personal observation to believe that if the face of the sheep had, like its body, been protected by wool but few cases of death by lightning would occur among the ovine species. In every instance that has come under my observation, I have found unmistakable traces of the point of impact on the skin of the face, of the electric fluid having taken its course thence, not on the surface of the wool, but along the skin itself—the roots of the wool being discolored (usually brown or yellow) and shrivelled. In some cases, the wool along the track of the fluid may be, as it were, seperated.

The arborescent markings and the mapping out of the course of the nerves and blood vessels—caused by the reduction of the hœmoglobin of the blood—so frequently seen on the body of man are much less pronounced on the skin of animals; nevertheless, such markings can be detected by dissection in the skin itself, and in the sub-cutaneous tissues.

True *rigor mortis* does not, in the vast majority of instances, take place in death by lightning, but the carcass usually retains the position assumed by the animal on its falling to the earth, and, as before remarked, when animals have been sheltering under a tree, the bodies are found grouped in a circle round its trunk, with the heads towards the center of the circle. After the lapse of a few hours the carcass becomes stiff from the liberation of gases, and the body and legs quite rigid; the latter are extended in a straight line. The body is tympanitic, blood or bloody foam oozes from the nostrils, the rectal mucous membrane becomes everted, and there may even be oozing of blood from the anus.

The blood, it is generally assumed, does not coagulate, and its hernate-globului becomes dissolved. Coagulation of the blood does, however, take place in some instances, and cardiac clotting is occasionally seen. Pulmonary congestion pronounced in some cases, but neither cerebral nor spinal lesions are, necessarily, to be detected.

Vagaries in the continuity of lightning-stroke are sometimes remarkable, but these vagaries can generally be explained by natural influences. Thus, indirect transmission may may be accounted for by a break in the line of contact of animals with the conducting medium. A good example of this is recorded in the case of a number of horses struck by lightning in the cavalry stables of Krasnoje-Selo, in 1883. In this instance, sixteen horses were killed outright, their companions suffering from temporary loss of muscular power only, and it was observed that, in the case of the dead animals, the electric fluid had struck the head or neck and passed downward to the fore feet. The hay racks were bound with iron, and their contents were burned, and it was assumed that the victims (picked out here and there) had, at the moment the electric fluid struck the iron, been standing with the head in contact with, or in close proximity to the iron.

In 1886, a case occurred at Camilla, New York, in which five horses, standing with their heads over a wire fence, were instantaneously killed. While an instance of remarkable escape from death is recorded in the *Lancet*, of January 11, 1879, in the case of a man from whose body the clothes were stripped; his watch, the buttons of his clothes and other metals were fused; and yet he, himself, suffered only from temporary injury.

FIRE.

In speaking of DEATH BY FIRE it must be borne in mind that there are other factors in operation to produce death, besides actual burning. Undoubtedly, actual cauterization is the most potent agent in the production of death and of severe injuries in animals exposed to the influence of fire, but there are usually other agencies in operation tending to the same end. Thus a fire may take place in a large building, within the walls of which horses, cattle and other animals may be housed, and after the extinction of the fire a number of them may be found dead, and yet in no case will traces of actual burning be discovered on their bodies. This is a common experience, and to those unversed in such matters, it seems, at first sight, quite inexplicable: a little thought and investigation will soon supply the explanation.

I have seen instances of fire breaking out in a stable, where the flame has swept along the edge of the bedding of each individual animal, and in which scarcely a mark was to be discovered in either stall posts or horses, but a number of the horses have been severely and even irrevocable injured.

I have seen one instance where the flame ran along a continuous hay-rack, and in which the hay was consumed and the rack charred, yet not one single horse was deprived primarily of life, but some were rendered either temporarily or permanently useless.

Again, I have seen a part of a stable consumed by fire, but out of five or six horses deprived of life, no trace of fire could be found on the carcass of any individual animal.

The explanation of all this is, that in these cases in which animals are not actually burned to death many of them die from SHOCK, or, it may be better expressed perhaps, from FRIGHT. I am quite convinced that in some of these instances SUDDEN CARDIAC PARALYSIS takes place.

In the vast majority of instances, immediate death is caused 1*st*, by *Carbonic Acid Poisoning;* 2*d*, by *Carbonic Oxide Poisoning;* 3*d*, by *Carbon Suffocation.*

In some cases these influences are combined.

CARBONIC ACID POISONING is distinguished on *post-mortem* examination by the dark, semi-coagulated condition of the blood, by pulmonary congestion, and by the heart cavities being surcharged, (especially the right), with dark colored and soft blood coagula.

CARBONIC OXIDE POISONING is distinguished mainly by the condition of the blood in the heart and large vessels, and by the absence of marked pulmonary congestion. The cardiac blood presents the appearance of masses of brick-red, waxy like matter, which does not alter on exposure to the atmosphere, while the pulmonary vessels, and even the capillaries, contain a similar material.

This condition of things, when it first came under my observation, somewhat puzzled me, but, on mentioning the matter to my colleague, Dr. Aitken, he informed me that the phenomenon was well known to chemists, and that it is due to the formation (by the action of the carbonic oxide upon the blood coloring matter) of insoluble compounds, which are not influenced or re-dissolved by exposure to the oxygen of the air.

This change in the blood most certainly exercises an important influence upon the system in some of those cases in which animals rally from the primary effects, but succumb to the secondary effects of exposure to an atmosphere charged with carbonic oxide; the normal lesion being of such a grave character as to be incompatable with the continuance of life.

CARBON SUFFOCATION is due to the minute bronchii and air cells becoming plugged with finely divided particles of carbon in the form of smoke.

The accumulated carbon prevents the interchange of oxygen and carbonic acid, and the animal dies of OXYGEN STARVATION.

In *post-mortem* examination the particles of carbon can be distinguished in the form of black lines arranged in a precise? manner in the small tubes, the blood and heart presenting the same appearance as in the case of carbonic acid poisoning.

IN DEATH PRODUCED BY ACTUAL BURNING the cauterized skin has a shriveled, charred appearance, while the fasciculi of the exposed muscles, in the horse at least, are rendered very distinct, almost as much so as if the inter-fascicular tissue had been carefully removed by dissection. The carcass presents much the same appearance as that already described as being characteristic of death by lightning.

The Secondary and Remote results of exposure to Fire, Hot Air, Steam and Smoke are more numerous, and on the whole, of more importance than are the primary.

They are, inability to rally from the effects of the primary shock, ante-mortem cardiac clotting, odema, (especially caused by hot air and steam) of the laryngeal tracheal and bronchial mucous membrane, sloughing of the mucous membrane, acute pulmonary congestion, and, in some cases, pulmonary hæmorrhage, bronchitis or broncho-pneumonia, emphysema of the lungs, cardiac derangement, nasal gleet, ophthalmia, enteritis, hœmaturia, tetanus and dermatitis with cellulitis.

INABILITY TO RALLY FROM THE PRIMARY EFFECTS OF SHOCK. In some cases, especially in horses, the vital forces though apparently annihilated for a time, are sufficiently powerful to enable an animal to throw off the immediate effects of the shock, but the depression of nerve force is so great as to render the carrying on of the functions of life an impossibility.

I am convinced, however, that in many instances this inability to rally is not due to nerve depression only, but, and probably in a much larger degree, to the grave physical and chemical blood changes which result from the inhalation of carbonic maroxide and dioxide.

In all cases of this kind, prompt and energetic treatment is demanded. Every effort should be made to rouse the vital energies, and to prevent cardiac asthenia.

A plentiful supply of fresh air should be allowed, general and special nerve stimulants administered internally, (brandy and ammonia *par excellence*), and active stimulating agents, as mustard or ammonia liniment, freely and repeatedly applied to the chest and legs. Stimulating inhalations and enemas are also useful.

ANTE-MORTEM CARDIAC CLOTTING may take place within a few hours after exposure, or not until after the lapse of several days or even a week or two. It is due, in part to the weakened cardiac action, partly to the altered (spastic) condition of the blood, and in some cases, is favored by pulmonary congestion. The indications of the occurence of this process are, great irregularity and fluttering of the heart's action, rapid, weak and very irregular pulse, marked pre-pectoral bruit, and on auscultation, a blowing sound is heard over the region of the valves. There is great uneasiness, and probably profuse perspiration, difficult and hurried breathing, and distension of the superficial veins.

Here again, prompt treatment, such as that above recommended, must be adopted. Digitalis, and, after the lapse of a short time, potassic iodide, are especially useful in dealing with this condition.

ODEMA OF THE MUCOUS MEMBRANE OF THE AIR PASSAGES results more largely from steam, than from dry, hot air. It takes place with great rapidity, and if very extensive, produces death within a few hours by asphyxia.

It may or may not be complicated with *Effusion of Serum*, if it is, the gravity of the case is enormously increased. *Nasal, laryngeal and tracheal stertor* becomes pronounced, and it is quickly followed by paroxysmal coughing, and the discharge of frothy serum from the nostrils; this, in some cases, is mixed with blood, and if smoke has been inhaled along with the steam, the odor of charred matter is distinctly detected in the expired air.

Recovery, from such a condition of matters, is scarce to be expected; nevertheless, hope need not be abandoned, even though the animal may be pulseless, and all chances of recovery apparently gone.

Carbonate of ammonia can be given repeatedly in the form of a ball, (drenching is out of the question), stimulating enemas thrown into the rectum, and stimulating liniments applied to the thorax, and over the region of the trachea.

Tracheotomy, low down, may be performed with the object of faciliting the outflow of the serum.

If the animal rallies *sloughing of the mucous membrane* is still to be dreaded, and if the œdema has involved large tracts of bronchial membrane, death by asphyxia inevitably ensues.

ACUTE PULMONARY CONGESTION may occur immediately, or within a comparatively short space of time after the exposure, or not until the lapse of two or three days. It is a common experience that horses sent out to perform their ordinary work after being allowed to rest for a day or two, subsequently to the exposure, become the subject of this lesion; the symptoms becoming very pronounced; and if proper treatment is not promptly carried out, they quickly succumb to its effects. In some cases the engorgement is so great as to lead to *throwing out of blood* into the bronchial tubes, and its discharge through the nostrils, either in a fluid or in a semi-coagulated state, and very dark in color. Here again the odor of charred organic matter in the breath is very pronounced.

The adoption of measures equally as prompt as those recommended for cardiac clotting are demanded in the latter case, in spite of the best efforts, and though life may be prolonged for several days, or even for a week, gangrene is almost certain to result.

BRONCHITIS AND BRONCHO PNEUMONIA are the natural sequelæ in those cases where the primary influences have not been sufficiently powerful to produce œdema or pulmonary congestion.

Bronchitis may or may not be preceded by or associated with *nasal catarrh.* It does not, as a rule, make its appearance before the expiration of thirty-six or forty-eight hours, and is most likely to result from exposure to a cold or cold and damp atmosphere.

Its symptoms and results do not differ in any material degree, except in the odor of the breath, from those of bronchitis, due to ordinary causes, neither is there anything special to be noted in reference to treatment.

The most important results of Bronchitis are broncho-pneumonia, chronic interstitial bronchitis and bronchonhœa.

BRONCHO PNEUMONIA, runs the same course and terminates in the same manner, though more likely to result in gangrene, as when arising from other causes.

If evidence, such as fœtid breath, of gangrene is forthcoming, the prognosis should be very unfavorable, as it is almost certain to terminate in death, but, notwithstanding this, antiseptic and stimulating treatment should be persevered with. Inhalations of terebene and creasote will asepticize the gangrenous products; stimulants and nutrients will support the vital powers until the *debris* has been got rid of.

CHRONIC INTERSTITIAL BRONCHITIS leads to thickening of the mucous and sub-mucous tissue, and by diminishing the calibre of the bronchioles, produces *asthma,* (one form of it), or as it is generally designated, *thick wind.* If this condition is not properly treated, it may render an animal useless for life, a least in so far as its power of performing hard work is concerned.

It may be cured or at least relieved, by the judicious administration of arsenic and potassic iodide, with nux vomica and careful feeding.

Bronchorhœa results from chronic catarrhal inflammation of the mucous membrane. Its duration is indefinite, and during its continuance an animal is practically useless. I have been very successful in arresting it by the application of a vesicant, such as Cautheim's ointment over the thorax and front of the chest; the administration of iodine, alternated with arsenic, and the inhalation twice daily of iodine fumes.

Pulmonary Emphysema may be *primary or secondary*; it is most likely to be the former, in cattle, owing to the histological difference which exist in the air cells and connecting tissue of the lungs, as compared with other animals, and in them is produced very rapidly and pronouncedly, in all conditions where there is material interference with respiration; e. g. in cattle plagues, exposure to foul air in the holds of ships, or to the effects of fog.

Secondary Emphysema may be compensatory in its origin, and due to organic destruction of parts of the lungs.

Cardiac Derangement is one of the most important and most frequent results of exposure to the influence of fire. It is most common in the horse and may result primarily from fright, secondarily, from important valvular or muscular changes. When resulting from fright it is due to the impression made upon the cardiac nerves themselves, or probably to muscular strain, produced by the violent action of the heart. *Palpitation* being present in a marked degree, in all animals rescued from burning buildings. The violent rebound of the heart may be sufficient, in some cases, to produce laceration of one or other of the valves, or of the chordæ tendinæ, and this supposition is warranted by the fact that these lesions are occasionally met with in horses and dogs that have been subjected to the effects of great and sudden excitement, violent strains or paroxysmal coughing; and by the further fact that one of the most common and important results of the action of fire and smoke in *valvular disease* either in the form of *tricuspid incom-*

petence, producing *jugular pulse or mitral obstruction*, producing *intermittence*. I am quite aware that the former may result from *dilatation of the auricular ventricular orifice* brought about by *dilitation of the ventricle*, and that the latter may be caused by the formation of *clots*, or even *vegetations* on the *bicuspid valve.*

I have sometimes thought that the *cardiac weakness* occasionally detected some weeks after the date of the exposure might be accounted for on the supposition that *fatty metamorphosis* of the *muscular fibrillae* had taken place in consequence of the organic nerve derangement.

While in some cases the judicious use of digitalis, nux vomica and ammonia, is successful in removing some of the symptoms above mentioned, it cannot be impressed too much upon the minds of practitioners that *cardiac derangement is one of the most important, most frequent, and most enduring of the sequelæ of exposure to the effects of fire and smoke.*

NASAL GLEET is a natural result of the primary nasal catarrh so often produced by hot air, steam and smoke. If it is properly treated in the early stages, it does not, as a rule persist; should it do so, it can, in the great majority of cases, be arrested by iodine fumigation and by the administration of such astringents and stimulants as iron and copper sulphate, and cantharides.

Trephining may be necessary, and should be had recourse to if milder measures fail in effecting a cure.

SUPERFICIAL OPHTHALMIA is the direct result of the action of fire itself—of hot air, or of the gaseous and solid products of combustion. If the cornea is primarily damaged symptoms of *keratitis* are immediately observed, and, in addition, there is ocular evidence of the loss of corneal structure; otherwise, *conjunctivitis* may not be established until the lapse of several hours, or even a day or two, after the exposure. If the inflammation has been caused by actual flame, confirmatory evidence is to be found in singed eyelashes and scorched lids—the latter, too, are much tumefied, sometimes everted, sometimes closed, this depending upon the presence or absence of Odema, and its extent when present.

The catarrhal inflamation of the conjunctiva may, if not promptly treated, continue for many weeks; as a rule it disappears in a few days, especially if venesection (of the angular vein) is resorted to with the application every few hours of a solution of cocaine—1 grain to the drachm,—and, after the lapse of two or three days, the alternate application of a collyrium of acetate of zinc. Should corneal ulceration result, the cocaine—as an anæsthetic—should be continued, and the ulcerated structure protected from the atmosphere by the occasional use of oleum amygdylæ dulc., medicated with 2½ p. c. of salicylic acid. Nitrate of silver or sulphate of zinc may be had recourse to if their use is medicated.

INTERNAL OPHTHALMIA is seldom seen, except the cornea is actually destroyed; in the dog, however, the great nervous excitement resulting from exposure to fire may originate *acute glaucoma.*

AMAUROSIS is an occasional result of extreme nervous excitement—it does not always yield to nerve stringli.

ENTERITIS is occasionally seen in the horse, not only as a sequel of exposure to actual fire, but as the result of the too severe application of the actual cautery in the operation of firing. In the most severe cases it is of the *phlegminous* type; but where it is due to continued irritation of the skin it is usually localized in the mucous membrane alone.

HŒMATURIA is less frequently seen than is hœmatinuria, and, when it does exist, is probably the indirect result of the latter condition, and is brought about by the irritant effects of abnormal matter from the blood passing through the kidneys and setting up violent congestion and *renal hemorrhage.*

Hœmatinuria is probably the result of an altered condition of the hœmato-globulin, brought about by the action of carbonic oxide and other deleterious, gaseous products of combustion.

Both of the above mentioned phenomena are of grave significance, pointing, as they do, to profound alteration of the physical and vital properties of the blood (especially the red corpuscles and their contents) in the one case, and to profound organic derangement of the kidneys in the other.

TETANUS is a remote result of cauterization, and is seen not only after exposure to fire, but, as in the case of enteritis, from the too severe use of the firing iron.

In the practice of Mr. R. Rutherford three or four cases occurred in one stud of horses.

DERMATITIS associated or not, according to the severity of the cauterization, with *cellulitis*, is an inevitable result of exposure to the actual effects of fire, as also of hot water, and even of super-heated steam. In some cases, the inflammation is superficial, and confined to the extremities, and most largely in horses secured in stalls, to the hind limbs. If, however, the flame has run along the racks and mangers, the skin of the head, breast, and fore arms receives the greatest amount of damage.

Pathologically, neither dermatitis nor cutaneo-cellulitis differ materially from that produced by other causes, such as the too severe use of counter-irritants or exposure to caustic acids or caustic lime, and such combustible material as pitch, petroleum, etc. Cases of the latter kind, it may be remarked in passing, being sometimes experienced in horses engaged in chemical works and new erections.

In the worst forms of injury extensive *sloughing* takes place, the resulting wounds being of such large area as to preclude the possibility of healing under a shorter period than several months. I have seen the healing process extend to eight and ten months; this is, especially the case where the loss of structure is localized in the angles of flexion or in parts subjected to stretching, as between the thighs.

In the practice of Messrs. Lawson, of Manchester, I saw, only last year, a cart horse suffering from acid cauterization of the skin of the internal surface of the thighs, and, in that case, the healing process was indefinitely retarded by the horse's own movements, in spite of such mechanical restraints as sling, stocks, and fetters.

DEFORMITY, produced by the contraction of the cicatrix in the healing process, is another result to be dreaded, and, if possible, guarded against in the healing process of extensive wounds. It must be prevented, when practicable, by the use of mechanical leverage secured by splints, plasters, bandages, lever-toed shoes, etc., as occasion demands.

Even in those instances where actual destruction does not take place, the skin becomes so enormously swollen as to cause great suffering by extreme tension, and to produce deep cracks or fissures and extensive suppuration with, in the end, the formation of ugly and disfiguring cicatrices.

The lips are sometimes so much swollen and cracked as to interfere with prehension; the nostrils are sometimes closed by the resulting tumefaction, rendering, in the horse, the operation of tracheotomy necessary. The labia of the vulva, in the female, and the anus become so much swollen in some cases as to produce marked eversion of their respective mucous membranes.

DEATH MAY BE CAUSED: 1st. From the *great nervous excitement*, followed by *exhaustion*, produced by the pain of the cauterization; and 2d. By exhaustion from *fever and subsequent suppuration.*

THE CARDINAL PRINCIPLES OF TREATMENT OF BURNS AND SCALDS are: 1st. To protect the exposed surfaces from the irritant effects of the atmosphere and the germs it contains; 2d. To relieve the pain and irritation as quickly as possible; 3d. To support the system, and thus prevent exhaustion; 4th. To circumscribe sloughing and moderate suppuration; 5th. To favor the process of cicatrization, and, in doing so, to prevent deformity.

The first indication is carried out by the immediate application of a layer of cotton-wool, flour, starch, arrow-root or other material, which will either protect the part absolutely from the air, or filter it, and thus remove irritating particles.

From a painful experience, I am enabled to assert positively that nothing gives so much relief as the immersion of the injured part in any bland fixed oil; unfortunately this cannot well be carried out in veterinary practice.

For large, superficial burns, the best application is the well-known "Carron Oil," to which may be added carbolic acid (1 in 12), or prussic acid (1 drachm to every 4 ounces). Liquor plumbi may be used with advantage as a substitute for lime water; and, contrary, though it may seem, turpentine liniments give great relief.

The second indication is practically met by the adoption of the measures recommended in the first.

In addition, however, to local application, systemic measures for the relief of pain should be promptly adopted. Large doses of morphia should be injected sub-cutaneously, and continued until the irritation is relieved. If pain and irritation continue exhaustion inevitably results.

The third indication is carried out by the judicious administration of easily digested nutriments and stimulants—brandy or port wine in preference.

The fourth indication can only be effectually fulfilled by the free use of antiseptics; pads of tow, oakum, or cotton-wool saturated with creasote liniment or glycerine. Carbolic acid should be kept in close apposition, by means of bandages or other appliances, with the exposed parts.

A paste of starch, glycerine and carbolic (or salicylic) acid is also very useful for this purpose.

Lastly, the process of cicatrization may be favored by the formation of an artificial scab. Probably there is no combination which fulfils the various indications as to treatment of burns and scalds so perfectly as a mixture of equal parts of liquor plumbi, comp'd tincture of catechu and terrebene.

Where there is much cracking of the superficial portions of the skin a little glycerine may be added to the mixture. I have sometimes seen the best results from the free application of znic ointment, but no matter what measures are adopted, the process of cicatrization in extensive injuries must necessarily be a tedious one. In some cases the healing process is facilitated by the existence of little patches (islets) of undestroyed skin left over the surface of the wound—each one of these acting as a formative centre, from which cicatrization goes on in a radiating direction.

In concluding my remarks on this subject, it may not be considered out of place if I give a few hints as to the rescue of animals from burning buildings, and as to the duty of veterinary surgeons when called upon to give reports as to the damage done to animals by fire, smoke or steam.

Rescue of Animals.—The greatest difficulty in effecting a rescue is always experienced in dealing with horses. The terror induced by fire or smoke in these animals renders them, in some cases, *frantic* and *uncontrollable*; in others, *paralyzed* and *bewildered.*

There can be no more miserable or exciting experience than that of witnessing the state of terror into which horses are thrown under these circumstances, and it is intensified when no means can be devised for effecting a rescue.

The wild neighing, the snorting, stamping, kicking and plunging of the victims, followed by stifled groans and moans as death approaches, make up a horrid and horrifying experience that few humane persons care to pass through more than once in their lives. The difficulty of rescue is sometimes aggravated by a curious tendency on the part of some horses to free themselves from their rescuers, and rush back into the burning stables. Such incidents are not uncommon, and serve to show the necessity of removing horses to a safe distance from the scene of a conflagration with all possible speed.

Various methods of dealing with refractory horses have been practised. Some animals will, with a little coaxing, walk out of a stable at once; others require to be blindfolded; others, again, can be coerced by the free use of the whip. Some can be backed out, while harness horses will, in the majority of instances, walk quietly out after the harness is put on.

In dealing with obstreperous horses, all available forms of force should be brought into requisition, and if ropes are at hand (with plenty of manual assistance) they should be placed round the chest and hind quarters, and the animals dragged out by main force. In the case of cattle, the necessary amount of traction may be applied by a rope placed round the horns.

In those instances where the flames have not reached the imprisoned animals and where, from surrounding circumstances, it is impossible to effect a rescue, provision should be at once made for the conveyance to them of a full supply of fresh air by breaking through windows, doors, or even walls. I have seen a number of good horses lost by the neglect of this simple precaution. I am quite aware that in some cases the establishment of a current of air will tend to aggravate the evil by increasing the activity, and favoring the spread of the flames, but there are numerous instances in which much good can be effected in this direction.

The Duty of the Veterinary Surgeon in acting as a skilled arbiter between an insurance company and an insurer is sometimes both an unthankful and an invidious one. He is, however, only called upon to use ordinary care in estimating the immediate and remote effects of such accidents; and in accordance with his knowledge of their probable effects upon the systems of the injured animals; to estimate to the best of his ability not only the existing, but also by the concurrent and the sequential lesions—what will be the ultimate extent of the damage sustained. In some instances this estimate can, from the nature of the cases, be only a speculative and an approximate one. I am of opinion that the best and most satisfactory method of procedure—so far as living animals are concerned—is to submit those that are injured to a careful examination by two veterinary surgeons—one representing the owner, the other the insurance company, and let them advise as to the desirability of immediate slaughter, or of the adoption of curative measures in each individual case. A second examination should be held after a sufficient time has elapsed to enable them to judge as to the advisability or otherwise, of continuing the application of remedial measures. In all severe cases of burns and scalds, and of lung injuries, immediate slaughter is both the most humane and most profitable course to pursue.

ART. XV.—RELAPSING FEVER IN ANIMALS.

BY JOHN C. PETERS, M.D., NEW YORK.

The official Bengal reports of Veterinary Surgeon, J. H. Steel, and Inspecting Veterinary Surgeon, G. Evans, are models in their way of good work, yea, very good work.

To Dr. Evans belongs the credit of being the pioneer in this new study, but his labors would have been very incomplete without those of Dr. Steel; while it is doubtful if the latter would have advanced as far as he has, without the preliminary work of his predecessor. Dr. Evans made his first discoveries in 1880, while Dr. Steel did not follow until 1884-85.

Dr. Evans first met with the disease in question, in the North-west provinces of India, west of the river Indus, towards the borders of Afghanistan. Shortly before, the 4th Punjaub cavalry had lost 350 horses by this new pestilence; but as far back as 1876, it had been noticed further west, in Persia. The disease was then generally referred to the use of hard, chopped straw for fodder, which scratched and irritated the mouths and throats of the animals; and to very impure water, the parasites in which, thus got access to the blood. There were irregular attacks of fever, in which the whites of the eyes, and several other mucous membranes became yellow; and petechiæ were also found upon them, especially in the nostrils and vagina. A few days after the animal was put upon the sick list, the fever seemed to subside, and even quite disappear; partial recovery took place, the appetite returned, especially for grass or green fodder; then unexpected relapses would occur, to the number of three or four, and in some cases up to seventeen. The animals were reduced to skeletons; anæmic palpitation of the heart was so severe that the sound could be heard some little distance off. Dropsy was apt to occur, and kidney disease was not uncommon. Some 272 sick horses fell under Dr. Evans' inspection. Then many mules, ninety-eight camels, and some elephants were found with relapsing fever, while bullocks and donkeys escaped. No contagion or inffection was noticed except that which seemed to be carried by a very large brown fly, as big as small bees, and called by a name, which when translated, means, "great needle stings." These flies bit so severely that the blood streamed down the horses' legs as if it had been squirted on.

This gave Dr. Evans a hint, and he introduced blood under the skins of healthy animals, taken from diseased animals by means of hypodermic syringes; he thus reproduced relapsing fever in horses, mules and dogs, and also succeeded when he made these creatures swallow many ounces of blood, drawn from the jugular veins of diseased animals.

He next discovered the parasite which was a *Spirillum* very similar to that which causes relapsing fever in human beings. Next .he found that these parasites came and went in successive broods; thus, for a few days, many would be present in every drop of blood, when the fever would run high, the thermometer registering 103 or 105° or even 107°: then they would all pass away, so that only one could be discovered now and then, when the fever would subside, but numberless spores or ova, resembling small granular specks, would be left behind in the blood, to hatch out in a few days more, and occasion a fresh relapse.

Dr. Evans' description of the parasite and its actions, is wonderfully graphic. "It has a blunt head, a tapering body and tail; its motions are undulating and eel-like, and as a rule wonderfully active. Its color is white and difficult to detect, and when dead becomes invisible. It attacks the red globules ferociously, it seizes, worries and shakes them, tears and bites out pieces, so that many red blood globules become shapeless particles of a pale red, jelly-like substance."

Finally Dr. Evans found these or very similar *spirillæ*, in stagnant water and on the root stalks of coarse grasses, and thought that the spores and ova might be conveyed by the winds to distant places and there develop under favorable conditions of heat and moisture.

He went so far as to give the carcasses of dead animals to jackals and pariah, or wild dogs, and thought they conveyed the germs of the disease to drinking water.

Dr. Evans found that the best method to examine the blood was to put a full drop of serum on the slide, lay a thin cover on press it moderately so as to squeeze some of the fluid from under the cover, all around; retain the pressure for a short time, until what has been pressed out dries up, and forms a good temporary cement, which will keep the serum within from drying: the movements of the parasites can then be watched for many hours.

Singularly enough, Dr. Evans did not call this disease a relapsing one, much less a relapsing fever. He did not call much attention to the relapses, and did not compare his *spirillæ* to those which are so well known in the relapsing fevers of men He regarded it as different in important respects, from any other disease ever reported upon, in man or beast: that it was quite new to science, and, as long as the spiral parasite found in the blood was not better known it was advisable to call the disease by the common country name of *surra*, which is an ordinary Afghan name for disease or *rot*, like sheep rot.

THE BURMAH EPIDEMIC.

Late in October, 1884, Inspecting Surgeon J. H. Steel, was ordered from India to Burmah, to investigate an epidemic among the transport mules and animals. He found it evidently not one of the ordinary diseases of the horse; and among the unusual disorders, the only one bearing any analogy to it was *surra*, as described by Dr. Evans, in 1880. Careful and sustaine *thermometric researches* soon enabled Dr. Steel to prove that it was a true *relapsing fever*, closely resembling, though not absolutely identical with the relapsing fever of man. He then inoculated dogs, horses, mules and monkeys, and reproduced the disease. His first observations were made on fifty-one mules and eleven ponies, out of which he made twenty post-mortem examinations ; finally he had 182 fatal cases, while his horses elephants and bullocks daily diminished in number, and finally the losses among the artillery horses was so great, that the field batteries had to be withdrawn from Burmah. The disease was first decreed to be ulceration of the stomach, which was often found, but that was traced to the use of coarse grass, harsh straw, and unhulled rice, which scratched and tore the enfeebled mucous membranes of the sick animals. The Burmah Veterinary Surgeons had already noticed the high fever and that it recurred, but these occurrences were regarded as separate attacks, not relapses.

Water, from certain foul tanks was suspected of producing the disease, especially as some of the hospital and regimental latrines drained into them, as well as some cemeteries where fever patients had been buried, and near which some of the mules and ponies grazed, In times of freshets and storms, the hospital and regimental privies were flooded, and their contents washed down into some of the stables. These hospitals had had many fever cases in them, doubtless some relapsing fevers, and the privies contained the excretæ of these and other fever cases in large quantities.

Hard usage, scanty, mouldy, coarse and improper food, exposure to incessant tropical rains, and drinking foul water, were supposed by many to be sufficient to account for the disease, but Dr Steel did not think such common causes of feverish attacks were competent to produce so peculiar a disorder. With the thermometer he could always diagnose the cases, and finally a careful watching of the pulse, and heat of mouth, also enabled him to do so : but, of course, the body heat as taken with instruments of precision, was by far the most satisfactory guide. At first the pestilence was regarded as a malarial typhoid affection with attending ulceration of the stomach, instead of the bowels: for Surgeons Steel and Frost had hunted for a month for parasites in the blood, and found none, as they were white and almost transparent. Next they were colored with aniline and magenta dyes, and the whole matter became clear. Dr. Steel also found that the *Spirillum* of relapsing fever in man and animals resembled very closely in form and movements, the *spirillum plicatalis* first described by Ehrenberg as of common occurrence in stagnant water. He too, saw the parasites seize the red blood globules, tear them from their rouleaux, shake them, distort them into various shapes, and show great energy, strength and perseverance in pushing their way through a mass of red corpuscles, and even to bore a passage through the capillaries more easily than leucocytes do.

Numerous inoculation experiments reproduced the disease in four to seven days with an abundance of parasites in the blood. The relapses as marked by the thermometer, occurred about every ten days, lasted several days, and then subsided to recur again. It was found if the thermometer and microscope were used every day for five days, a diagnosis could almost certainly be made out, *if they were used for ten days a positive statement as to the presence or absence of the disorder could be made out, without the possibility of error.*

Enough has perhaps been written for the present. I would merely call attention here to the great similarity between this relapsing disease and the well-known *Beri Beri* of India and Japan. The more carefully the descriptions of the two are studied, the more will it seem that both are varieties of relapsing fever.

Nor is the chapter of the resemblances between human and animal diseases yet closed. In 1881 the first Punjaub Infantry in the northwestern provinces of India, lost in a few weeks over forty men of infectious pneumonia, out of a strength of 550; and the fifth Punjaub Infantry lost sixty men. Dr. Costello says that at the time the epidemic appeared among his troops they had just been marching through districts of Afghanistan known to be affected with the cattle plague, called contagious pleuro-pneumonia, from which source the soldiers seemed to have caught the infection.*

It is also equally well known that the great epidemic of cerebro spinal meningitis commenced in this city in a severe outbreak among horses in 1872, fully a year before it appeared among men: and that it has ever since persisted in a mild degree. There have been few signs of infection manifest of this, and some of the other diseases from animals to men, and still fewer of direct contagion. But that all these diseases are communicable in some mysterious way, far more occult than the transmission of typhoid fever, is very evident. Typhoid fever is not at all contagious in the ordinary sense of the word, but that it is one of the most communicable diseases when its poison gets into drains or water courses is well known. Relapsing fever is one of the most contagious diseases in human beings; while among animals its infection seems to sink down to a plane comparable to that of typhoid fever. Horse influenza will run through the whole of a large stable if a single contaminated animal is shut up in it over night; but it does not affect the stableman, except rarely. Human influenza is an exceedingly communicable disease to other human beings, but does not seem to affect animals. Up to lately the pleuropneumonia of cows has not seemed communicable to human beings, but we do not know what ravages it may have caused among delicate persons. A few years or merely months ago, any one who had spoken seriously about infectious pneumonia and consumption among human beings would have been hooted at: now every one believes in them. The whole doctrine of infectious contagion will have to be rewritten in the near future.

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*See Wm. Wood Co.'s reprint of Prof. German See's Diseases of the Lungs, p. 64.

EDITORIAL DEPARTMENT.

Dr. Spitzka on Hydrophobia.—We devote a large space of our journal to Dr. Spitzka's able paper on spurious hydrophobia, together with the discussion thereon. The doctor shows that he can produce the same disease in a dog by inoculating almost any foreign substance into the brain, as Dr. Liautard obtained by inoculation from a supposed rabid dog. The author of the paper seems to have been somewhat misunderstood, if we are to judge from recent editorial notices in the daily journals. He did not, as they assume, or as one of the speakers of the evening assumed, claim to have produced genuine hydrophobia, or deny the existence of such a disease. He distinctly repudiated discussing that question, and it appears to have been his main purpose to quiet public alarm by showing that genuine rabies is an extremely rare affection and that at present it cannot be pronounced to be epidemic either in New York or its vicinity. Regarding it from a purely philanthropic standpoint, Dr. Spitzka's observations should be widely circulated. They point out the influence of fear in stimulating the symptoms of hydrophobia, and even inducing the disease itself. In view of these facts, and the special pains taken—as we are informed—to secure the presence of the incorporators of the Pasteur Institute of this city at the reading of the paper, and eliciting their views, we cannot but regard it as most unfortunate that both Drs. Mott and Liautard were compelled to excuse themselves owing to other engagements. It is not calculated to create a pleasant impression that no representative of an institution which is calculated to flourish by appeals to public confidence, saw fit to be present at so important a meeting as the one which took place last Thursday. One of the most well-timed and thoughtful suggestions made in the course of the discussion was that made by Dr. Dulles, of Philadelphia. Dr. Dulles is an outspoken opponent of the existence of lyssa in man, in the sense that term is used in most text-books and treatises. He called attention to the fact, and we are surprised it has not been touched on before, that Pasteur obtained his original virus (with whose derivatives he is now working) from a *single dog*, as to whose having had rabies in reality there is great doubt, for Pasteur was at the time not an expert on rabies. It strikes us that, in view of this revelation, the suggestion of the *Deutsche Medizinische Wochenschrift* quoted in the paper read, as to the need for corroborative experiments is very well timed. A very important admission was frankly made by Dr. Biggs, of the Carnegie Laboratory. He confessed that though Neall, the Newark pound-keeper, was regarded as a subject of hydrophobia, inoculations of rabbits and dogs, made by himself and by Prof. Law, of Cornell, proved entirely negative. Although he took opposite ground to Drs. Dulles and Brill—the latter of whom delivered a telling indictment of Pasteur's peculiar announcement *apropos* of German opposition, he really sustained their position against Pasteur, by admitting that the rabbit has no characteristic signs of rabies. The importance of this admission is due to the fact that Pasteur, for some unaccountable reason, has not selected the dog, but the rabbit, as the medium for the cultures of hydrophobia virus. Dr. Bigg's admission also invalidates the value of the experiments made with material from Dr. Kretchmar's Brooklyn patient, on a rabbit by Dr. Sternberg, in Baltimore. The paraplegia found in the latter case was pronounced by Dr. Biggs exactly as that in Dr. Liautard's case was stigmatized by Dr. Spitzka as the result of ordinary brain paralysis. C.

OZONE AND PNEUMONIA.—Dr. Daniel Draper, Director of the Central Park Meteorological Observatory, in his report for the year 1885, furnishes some very interesting data on the subject of pneumonia. Having made a systematic study of this disease from a meteorological standpoint, comparing the mortality statistics obtained from the Board of Health, with his recorded observations, he found that a high death rate from pneumonia corresponded with an increase in the quantity of ozone in the atmosphere, and *vice versa.* The connection between these conditions, although not sufficient to demonstrate their relation of cause and effect, justifies further investigation. We would suggest to those in charge of large numbers of animals to keep a record of the cases of pneumonia occurring amongst them, and make a report of the same. Veterinarians would then be enabled to make comparisons between these cases and the variations in the quantity of ozone in the atmosphere, obtainable at the nearest meteorological station, and thus help to throw light on this important subject. To establish the fact that there existed a connection between ozone and *cases* of pneumonia would be of much greater value in the elucidation of the question than to demonstrate the relation between the same atmospheric conditions and the *deaths* from pneumonia.

C.

VETERINARY LEGISLATION.—The New York State Veterinary Society has succeeded in procuring the passage by the Legislature of this State of a bill to regulate the practice of veterinary medicine. The first section of the bill states that every practitioner must be duly registered in the office of the Clerk of the County in which he resides. The second section provides that no person is entitled to register unless he be a graduate of a legally chartered or incorporated college or university, or holds a certificate from a legally incorporated veterinary society. The third section admits all persons who have been practising veterinary medicine and surgery three years preceding the passage of this act, and who are without the necessary diploma or certificate, to register the same as those provided for in section two; provided, the same is done within six months from the passage of this act. The rest of the act provides that any person practising veterinary medicine and surgery without conforming to this act shall be guilty of misdemeanor, and liable to a fine of from $50 to $250 for each offence.

DIAGNOSIS OF TUBERCULOSIS IN CATTLE.*—Leidmann deduces the following conclusions from some practical studies upon this question: 1st. The mucous secretion of the trachea always contains the specific bacilli when extensive processes of that nature are seated in the lungs. The germs can always be diagnosed intra vitam, but failure in doing so would not necessarily exclude the possible existence of tubercular processes in the lungs. 2nd. The milk of tuberculous cows contains the bacilli, even when no macroscopical evidences of the disease are observable in or around the udder. 3d. Tubercular processes in the intestinal canal can also be diagnosed by the presence of the specific bacilli in the discharges.

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* *Wochenschrijf fur Thierheilkunde,* No. 9, 1886.

We beg to acknowledge the receipt of the kind invitation extended to us by the members of the Medical Press and Library Association in behalf of the "Weekly Medical Review," to attend at a dinner at the St. Louis Club, and to express our sincere regret at our being unable to be present at such an agreeable reunion.

Proceedings of Veterinary Medical Societies.

At a meeting of the Medico-Legal Society, held in New York City, Thursday, June 10th, presided over by the Hon. Amos G. Hull, Vice-President, in the absence of the President, Dr. Frank H. Hamilton, the following discussion took place after the reading of Dr. Spitzka's paper on hydrophobia.

Dr. Dulles expressed the pleasure it gave him to be present at the meeting to hear the interesting and instructive paper of Dr. Spitzka, and to see the animals upon which he had experimented. He thought these experiments were of peculiar value as filling up a gap in the argument of those who did not believe in the specific nature of hydrophobia, nor in the theory of preventive inoculations with a so-called virus, as done by Pasteur. It showed that by the inoculation of matter which had no "specific character," symptoms could be produced such as Pasteur relies upon as evidence of rabies. He was opposed to the publicity given to the claims of Pasteur, and to the credulity with which they have been accepted. He believed that the more hydrophobia is talked about, the more prevalent it is. One of the effects of Pasteur's work has been an enormous increase in the number of cases of persons who considered themselves to have been inoculated with the virus of rabies, and to be exposed to the horrors of hydrophobia. If we admit Pasteur's claim, that he has saved more than nine hundred persons from hydrophobia in the last nine months, it appears that except for Pasteur the death from this disorder in France, would have risen from about fifteen a year to about four thousand! Pasteur claims to have proof that all of these persons were bitten by actually rabid animals, and that he has "cured" them of hydrophobia, in the stage of incubation. But those who do not believe in his theory, cannot admit any such claims. If we judge by what we know best about, we cannot have much faith in the madness of the dogs which bit Pasteur's patients. The Newark children still figure in the list of Pasteur's cures. We now know very well that the dog which bit them was not mad. There is not a particle of good evidence that it was. Of the bitten children, six in number, four went to Paris to be cured by Pasteur, and two remained at home and are just as well to-day as those who made the journey to Paris. Of the dogs bitten by this dog, which is said to have been mad, not one has since shown signs of rabies. Dr. Anna Kingsford, of England, has interested herself in this matter, and has investigated the cases of cure said to have come from her country, and she has not found one which will bear sifting She calls attention to the point that when the cases which we can find out about turn out so unfortunately for Pasteur's credit, it is hardly worth while to trouble ourselves about those in regard to which we cannot get accurate information. It is a remarkable fact that Pasteur is constantly claiming infallability for his methods. In his last communication to a correspondent of the Boston Medical and Surgical Journal, he speaks in the customary positive way. Dr. Dulles had examined the subject of Pasteur's experiments, and found, that to justify his claims, he must have performed *without a single failure*, a number of series of experiments, each series requiring from 130 to 140 rabbits, and covering a period of nearly three years. Pasteur would have us believe that he has done all this without such failures, one of which would have broken up a whole series. But when we investigate the case upon which the success of his method hung—the case of the boy Meister, which gave him "cruel inquietudes"—we find that by Pasteur's own admission, one half of the material on which he relied to save the boy's life, and his own reputation, contained no virus at all! It is a curious illustration of Pasteur's carelessness, that, in speaking of the eleven inoculations which he made on this boy, he says that five of them, on being tested subsequently, were found to contain virus, five to contain none, while he omits altogether to account for the eleventh. And it illustrates Pasteur's forgetfulness, that in spite of this record, he even yet speaks as if his method were infallable. Is it remarkable that one should doubt this, in view of the fact that it disappointed Pasteur in half of the crucial tests in the case of the boy Meister?

Dr. Dulles said he had elsewhere gone in detail into various questions in regard to hydrophobia, and he wished to emphasize the point that evidence must be estimated according to its quality, and not its quantity. He believed that there was no more or better evidence, to support the specific theory of hydrophobia now, than there was a hundred years ago to support the belief in witchcraft. There were, in those days, a large number of respectable and intelligent witnesses, to prove the existence and the dangerous effects of the "evil eye." There were people who would die in the faith of having seen witches riding through the air. Such opinions are discarded now, and he believed that in fifty years the specific theory of hydrophobia would be abandoned. Certainly, if thinking men set their faces against the false notions in regard to it, which are too much proclaimed at the present time, the number of cases of hydrophobia would be much lessened. The number at present was very largely made up of three kinds of cases: those in which the spmptoms were due to some distinct and recognizable disease, those in which they were due to some form of mania, and those in which there was a pure state of fright. If these are well understood, and all cases attributable to them are eliminated from the discussion, as they ought to be, then there may be left a small residue, though he hoped there would be none, in which the symptoms would have to be explained in some other way.

Dr. I. N. Quinby said: *Mr. President and Gentlemen:* The call from your presiding officer for me to say a few words on the profound and varied questions involved in rabies, which important question is now agitating the community, comes to me very unexpectedly; for I came here to listen rather than to debate. But I will venture to say, however, that I am fully in accord with the sentiments and acts brought forward by Dr. Spitzka,—in his very able and important paper, and with his laudable efforts to let some true light, which is so much needed just now, on this occult and much misunderstood question of hydrophobia.

When we consider fully the influence of fear, anxiety, fright and joy upon the nervous centers; when we consider that persons have died within a few hours from fright; when we know that persons in robust health, may be transformed, by the unexpected loss of friends or possessions into permanent loss of health, into convulsions, loss of reason, even to committing suicide, etc.; may this not help us to explain why in times of Hydrophobic scare we have many cases of spurious hydrophobia (Lyssaphobia)?

No Physician however profound, no Neurologist, whatever may be his experience, has been able yet to fathom the mysterious workings of the nervous system under the profound agitation of the mind, or to discover what influence this agitated mind may have, through the reflexation of the nervous system on morbific agents that may have already been planted in some of the organs of the body. I am fully convinced that many of the reported deaths from hydrophobia (Lyssaphobia) have been brought about through fear and fright.

I fully concur with the sentiments expressed in Dr. Spitzka's paper in reference to the unreliability of the reported cases of cure by M. Pasteur, as in most of the cases sent to him it was not proven that the patient had been bitten by a rabid dog. Certainly there was no reliable evidence that the children sent from Newark, N. J., were bitten by a rabid dog, neither was there any evidence that Miss Morosini was bitten by a rabid dog, and the *post-mortem* evidence, revealed by A. F. Liautard, M. D. V. S., were of no practical value as bearing upon hydrophobia.

I have had some experience in the examination of dogs said to have died from hydrophobia. I will detail the result of the *post-mortem* of one which, with some modification, will be the history of all: My little son had a Spitz dog, the character of which, without any apparent cause, was suddenly changed from a playful to an irritable snappish mood, refusing either to eat or drink, frothing at the mouth, and snapping at everything that came in its way, and finally on the second or third day went into violent convulsions. While in these convulsions I put it under the influence of chloroform, keeping it under the influence for half-an-hour at a time; but after coming out of the influence of the anæsthetic it would go off into convulsions again, and continued in that condition for three or four hours, when death put an end to its sufferings. It was said by all of my family and the neighboring physicians that this was a genuine case of hydrophobia. But, being skeptical myself upon the subject I made a *post-mortem* and discovered that a *sharp chicken bone about one and a-half inches long* had *perforated* the *intestines.* In addition to this chicken bone which was the prime cause of this dog's death, with *characteristic* symptoms of hydrophobia, there were other marked intestinal lesions with as much of the *characteristic evidence* of *hydrophobia* as that discovered by Dr. Liautard, viz., congestion of the fauces, empty and congested condition of the intestinal tract, stomach containing straw, worsted from carpet, &c., &c.; kidneys congested, bladder inflamed, contracted, and empty, effusion in brain and along spinal cord.

This hydrophobia scare subsided, not as rapidly, however, as it arose.

This is a fair sample, I think, of the kind of hydrophobia that nine of the canine species are afflicted with. One great good, Mr. President, I think will result from Dr. Spitzka's valuable paper, namely—that it will call the attention of the profession and the public sharply to the fact that many of the persons bitten by sudo-hydrophobic dogs will not have hydrophobia because the dogs were not rabid, and also to the importance of preserving the dog that has bitten a person long enough to know whether or not it develops true rabies, or, better still, until the dog dies of the disease, which would settle all doubt as to its true nature.

The action of Dr. L. D. Bulkley and Dr. Liautard smacked rather more of a sensation than of a scientific procedure, and would tend to do more harm to the community than good to the patient. *What evidence have we that the virus used* by M. Pasteur is the *true virus of rabies?*

The British Hydrophobia Commission, which is now investigating the question, are still in doubt in reference to this vital point, and however valuable the labors of M. Pasteur be, yet until this point is settled, that part of his investigation will be clouded with doubt and uncertainty.

Dr. M. G. Dadirrian said: I am from Constantinople, and have practiced medicine there, and have traveled in Asia Minor. I saw more dogs in the streets of Constantinople, than there are doctors in this room, If any of you gentlemen have ever been in that city, you will have seen as many dogs, at once, on the street, as there are trucks on lower Broadway. These dogs are born, live and die in the streets. They are very thin, and dirty and emaciated, but they do not have hydrophobia, though they quarrel and fight with each other, both day and night, over a small piece of bone or food. They are supported by small pieces of bread that the religious people think they ought to give them. During my practice in Asia Minor, I did not see any cases of hydrophobia.

A number of doctors used to meet together in Constantinople and talk about hydrophobia. Among this number were German, French, English and American doctors, I have never heard from any of them that he had seen a case of hydrophobia, though that was in a country infested with dogs. Very many of the people there, have the idea that there is such a thing as hydrophobia. The people speak of it as "Mad Dog." I think it is more imaginary than anything else. Now, to show that we would know of the existence of hydrophobia, if it existed at all, I will tell an instance. The Turks don't believe in the doctors, but when they get sick, and think they are going to die, they send for them. So, if there was any hydrophobia some of us would see it.

I read in the Constantinople papers, some time ago, that there had been a good deal of talk about hydrophobia, but I did not read an account of anybody dying.

The Turkish Priests will not permit the destruction of these dogs, or the taking of them from the streets. They claim that it is necessary to keep the dogs in the streets, because their religion tells them that when a man sins against God, and goes and asks pardon the way he knows his sins are forgiven is when he goes to a bakery and buys two or three loaves of bread and offers them to the dogs to eat, if the dogs eat the bread, his sins are forgiven. The people also provide tubs for the dogs to drink from, so that they will not become mad. Sometimes the people are bitten by the dogs; in such cases the people keep the dogs and do not kill them. This being so, we had come to the conclusion, before we heard anything of Pasteur, that we hardly believed in Constantinople, that there was such a thing as hydrophobia.

Dr. W. E. Brill said: As one who has paid some attention to the subject of hydrophobia, to the question of its existence in man, and one who is deeply interested in the discovery of

Pasteur, I am pleased to have listened to the paper of this evening, which expresses my views of the subject in every particular. With Dr. Spitzka and a very few others, I am on the minority side of a question which has been received by almost the entire world as truth. I am fully aware that our position is not very enviable, and that like all dissenters, we expose ourselves to the ridicule of the rest of mankind.

I would be the last one in the world to disparage the work done by Pasteur in other fields, work well done, and with good results; but to accept a theory as truth, simply because it comes from a man who has demonstrated some other scientific truths, is not only dangerous, but unreasonable, and I don't intend to be in the fashion of the present, which follows this method.

You may say: why surely he has proven his discovery by the fact of so many successful inoculations. But irrespective of my belief that there is no hydrophobia-producing virus residing in any tissue or secretion of a rabid animal bitten, but only in the imagination, let me argue the above on the same statistical ground. First, of fifty-nine animals inoculated by Hertwig, only fourteen were infected, three or four inoculations being necessary to secure infection in some cases, showing thus the immunity from the poison, and the difficulty of producing its effect on the animal to be very great. Second, in the year 1881, Gastier * made numerous experiments and arrived at the conclusion that the contagious element in hydrophobia was contained in the saliva of the dog, and that inoculation with the parotid or sub-maxillary gland, the brain juice, the stomach contents, the muscles and the pancreas led to no infection. He cultivated the virus of a hydrophobic dog in normal saliva, and vaccinated guinea pigs with it. These then died in from four to twelve days, but on vaccinating back from the saliva of the deceased guinea-pigs to dogs, he was *unable* to produce hydrophobia; only an ordinary septic influence resulted.

We are all aware that the character of the secretion is altered in an animal enraged or in fury. The accidental bite of a human being is not septic, but I have seen some of the worst forms of lymphangitis and cellulitis occurring in persons injured by a bite during a fistic encounter, but never a nervous disease allied to hydrophobia. The infection from certain snake bites is often attended by fatal results, but never by similar phenomena attributed to a bite from a rabid dog; and the bite from other animals do not present any other features than those just mentioned; then why should that of the dog manifest a specific result in the form of a special grave nervous affection?

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* *Journal de Medecine Veterinire de Lyon*, 1881, *p*. 168.

Even in what authorities regard as real hydrophobia in man it is remarkable that a large group of *symptoms* are of a kind *not* found in the animal from which the tissue is transmitted, nor, indeed, in any other animal subject to inoculation. It is also remarkable that these symptoms should happen to be the *traditional* ones of dread of water, spitting out saliva and terror. I quote the following extract from an Austrian treatise, which has had the honor of an American translation.*

"This feeling of abhorrence of water may increase to such a degree that a paroxysm will develop from a mere sight of water, from contact with it, from hearing the noise made by pouring it from one vessel to another, or, perhaps, from merely hearing compresses wrung out. * * * If the patient attempt to drink, or if the skin be moistened with water, spasms develop, which are attended with asphyxia, convulsions of the pharynx face and entire body, and a condition of intense excitement."

Of 216 cases of hydrophobia in man collected by Thamayn, six terminated in recovery; in other words, one out of thirty-six cases of what the authorities would regard as undoubted transmissions, got well without being "Pasteurized." I believe the results of "Pasteurization," if that procedure be shown to be entirely harmless (I myself should fear septic infection by his method) are no better than those due to nature. Pasteur includes among his alleged cures such cases as the Newark children and the historical one of Joseph Meister, who, it is now definitely established, had no hydrophobia at all, and had been bitten by dogs inferentially free from that disease.

Almost every day brings us news of a death of a patient under Pasteur's treatment. One of the Russians inoculated by Pasteur and discharged from his laboratory as secured against the disease, died of rabies on the journey home. This makes up a total of twenty-six persons bitten by mad wolves, and treated by Pasteur's method within the time prescribed by him, in all five deaths, or nearly 25 per cent. This percentage is as large as has ever been reported in cases bitten by dogs, I believe. It is not surprising that M. Pasteur wishes to exclude the persons bitten by wolves from his statistics, and rests on the 907 cases (April 29, 1886) which, like the boy Meister or the Newark children, had not been bitten by mad dogs at all. It is difficult, in view of the medium through which Pasteur's statements reach us, to learn what his exact views are ; but, if it really be true that he has stated, as was reported by the cable dispatches, his method to be efficacious against the dog rabies and inefficacious against the virus of the wolf, I do not think that I could present to you a more inconsistent statement to prove my previous assertion, or that we would be justified in discussing his method at all.

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* "A Clinical Treatise on the Diseases of the Nervous System." By M. Rosenthal. Wm. Wood & Co., 1879. Vol. ii., p. 100.

When Pasteur first promulgated his discovery, he guaranteed to cure any and all cases of hydrophobia that might occur, without reference to the time elapsed after the reception of the bite. When he met with the first death under his treatment, he stated that the patient arrived too late, that the virus had already produced the disease, and so with occurring reverses, he finally settled, after fixing the time at thirty-six days, upon the period of fifteen days as the incubatory stage. The daily press of June 7th reports the case of a death of a farmer from Roumania while under treatment by M. Pasteur. The Roumanian was bitten by a rabid dog on May 11th, and reached Pasteur on May 25th. After eleven days' treatment he showed symptoms of hydrophobia (June 5th), and died after forty-eight hours. The dispatch says, "This man's death and all the circumstances attending his case are held to upset the theory about the period required for hydrophobia to incubate, for the farmer was under M. Pasteur's treatment a long while before the expiration of the time heretofore deemed requisite for the poisonous saliva to obtain control of the victim's system. Dulles,* who has shown the fallacious argumentation and untrustworthy character of Pasteur's experiments, says in this connection, "how soon the short space of fifteen days may be reduced to fifteen minutes, we may tremble to contemplate, in view of the rapid rate of reduction which has prevailed thus far."

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* "Comments on Pasteur's Methods of Treating Hydrophobia." By C. W. Dulles, M.D. The *Medical Record*, Feb. 13, 1886.

In view of this remark, I would hence say Pasteur institutes would have to be situated not only in every capital city, but in every village, nay, in every house and at every cross-road, if the persons bitten were to be inoculated in time.

Lorinser,* Dulles,† and other critical reviewers of Pasteur, have stigmatized his methods as imperfect and his manner of argumentation as faulty. I believe that no one will venture to deny that the rapidity and confidence with which he proclaims successive new discoveries tends to create the suspicion that they are not always properly matured.

I am aware that the objection that Pasteur is himself not a physician, aside from the fact that a medical degree is not a *conditio sine qua non* of biological ability, can be met by the fact that the first two boys inoculated by Pasteur were examined by no less a one than Vulpian, and pronounced to be inevitably doomed to die of hydrophobia unless Pasteur could prevent it. But this very assertion of Pasteur's friends shows how absurd it is to allow ourselves to be biased by the weight of a great name. If a medical student had made the statement of Vulpian and Grancher on the same ground that they did, namely, because there was severe laceration and many bites, it would have been justly stigmatized as puerile. There is no way of telling that a person is going to become hydrophobic before the outbreak of the disease.

If Pasteur is pursuing his present inquiries in a philosophical frame of mind, conscious of a great discovery, which is sure to be recognized, as all truths are, does the language which he recently used indicate it? The correspondent of the Boston *Medical and Surgical Journal* reports it as follows: "In reply to my remark that the drift of opinion in America seemed to be that it is necessary to wait for proofs of protection in those already inoculated, he (Pasteur) said with great energy, 'Wait! I have no objection. I am waiting. But consider this; in October last I began systematically to inoculate human beings. Up to this moment (April 29th) we have inoculated 907 persons. How many deaths? One. One only (for the Russians cannot justly be counted), and when this one, the Pelletier child, came to me, it was too late. Before I began to inoculate human beings, how many of those bitten by mad dogs in France died? Sixteen per cent. Since last October, only one death in 907 cases. What more can you ask? Scientific men once doubted my having discovered a means of preventing cholera in chickens, and charbon in sheep. When I announced my discovery at the International Medical Congress in London, Koch said "pooh," and Chauveau simply loaded me with sceptical objections. Do they do it now? Let the fact that 500,000 sheep are inoculated every year in France for peasants who fight to save a two sous piece, and yet must pay four sous per head for inoculation every spring, be the answer. The Germans are angry, especially Koch, because France has the merit of this new discovery of protection against rabies. They think because they conquered our country in 1872 that they can be our masters in this field, and therefore they spread broadcast their scepticism against me. They lack generosity. They are behaving like children.'"

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* *Wiener Medizinische Wochenschrift*, 1885, No. 51, p. 1562.

† "Comments on Pasteur's Methods of Treating Hydrophobia. *Medical Record*, Feb. 13, 1886.

Whoever heard of the Germans objecting to the originality of Voltaire, De la Mettrie, Laplace, Arago, Bonpland, Cuvier, St. Hilaire, Cruveilhier, or Charcot, because a former monarch of the French had ravaged the finest province of Germany with such unprecedented barbarity that from the Pope to the Highlanders all Europeans stood aghast.

But questionable as his statistics are, can he show better results than Youatt, whom Hammond quotes,* as employing cauterization in over four hundred persons bitten by rabid animals, and never unsuccessfully. He employed it four times on himself, but finally committed suicide under fear that he was going to have the disease.

It is fortunate to the cause of scientific truth, that the warmest admirers of Pasteur should be among the laity, and not among medical men, but he is also very unfortunate in his medical adherents, for it is these admirers, whether with or without his sanction, have resorted to advertisement, which is in no sense different from that of a circus show. Whenever public interest threatens to flag for a moment, the cable brings us news of some new order of merit by the Emperor of Brazil, or a new grant to the Pasteur institute, or the name of some distinguished physician who goes to Paris to study Pasteur's methods. It is exceedingly unfortunate that some of these grandiloquent announcements were entirely false, while others were misrepresentations. Thus it was stated that Duke Carl, of Bavaria, together with his Duchess, both of whom are practitioners, were about to proceed to Paris to study Pasteur's system. The former's assistant, Dr. F. Tausch, was forced to declare that this was without foundation.* It was also reported that the Austrian government had sent a delegate to Paris for the same purpose. In truth, it was a private person, a Princess Metternich, whose record is about as savory as that of ex-Queen Isabella, of Spain, and who is ready to play any part from a ballet girl, to a bazar-patroness in the interests of charity to others and notoriety for herself, who sent Dr. Fritsch on this errand.

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* A Treatise on the Diseases of the Nervous System, 6th edition, 1876.

It is remarkable, considering the enthusiasm reigning among the adherents of Pasteur, that there should be so much jealousy and distrust among them. It is particularly the American disciples who show a feverish ambition for leadership, and an impatience of rivalry, which, considering the slight amount of expenditure of intellect involved in cataloguing dogs and rabbits, and making hypodermic injections, seems to indicate a very unhappy frame of mind.

In conclusion, I cannot do better than to again have recourse to Dr. Dulles'† most admirable review of the methods of Pasteur, who says: "I venture to express my opinion that Pasteur's so-called method of treating hydrophobia, before the outbreak, *does* appear to be founded upon untrustworthy experiments and unsound reasoning, and ought to be rejected and condemned, in the interests of humanity as well as of science.

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* British Medical Journal. May 22d, 1886, p. 991.

† Opus. cit.

. . . . Pasteur's arrogance, impatience of correction, ignorance or disparagement of what others have done, his secret methods, his hasty assumptions, his illogical conclusions —have made him many scientific and personal enemies. But, after all, Pasteur is the man who placed on a new and apparently secure basis our knowledge of the nature of ferments; who disproved the theory of spontaneous generation; who laid the foundation upon which rests the whole system of antiseptic surgery, for the establishment of which the name of Lister will be justly immortal. Such a man is Pasteur, and, whatever of error may seem to mar some of his last endeavors, and however the future may adjudicate some of their claims, he seems to me to deserve all the honor he has received for his unwearied labors, and his magnificent achievements in the cause of science."

"His very achievements in the right direction, however, make any error on his part all the more dangerous to the cause of truth, and makes it all the more the duty of thinking men to sift the evidence upon which he rests his extravagant claim of having discovered a means of preventing the outbreak of hydrophobia."

Dr. H. W. Biggs said: The sentiment to-night has been against the existence of hydrophobia, and entirely against the work of M. Pasteur. I wish to make some statements in correction of this, and to express my entire disapproval of the conclusions reached. In the Newark case, six children were bitten, and four were sent to Pasteur and returned cured. In another case, a lady was bitten by a dog in the street, and the idea of hydrophobia never occurred to her at all. Some weeks after, symptoms of hydrophobia manifested themselves and she died. It is said that the diagnosis of that dog rested entirely on the authority. The diagnosis did not rest upon the autopsy of the dog. It is admitted that the four children that went to Paris have not died, neither have the two that remained. Now that the latter two children lived does not prove that the other four did not have the hydrophobia.

Another case, is that of the keeper of the dog pound. He was bitten. I believed at the time that it was a case of hydrophobia. I agreed with the diagnosis that it was a case of hydrophobia. I made the autopsy the following day. I made inoculations from this dogs virus on other dogs and on rabbits. One of my dogs, so inoculated, had signs of paralysis nineteen days after. I did not believe it was a case of rabies, for it developed after the period when rabies could have been expected. I have made other inoculations and have had no better results. Of course, there was foreign matter found in their stomachs, but that is to be expected in all dogs. The other dogs inoculated are doing well. Dr. Law also made some inoculations, with about equal results. One of the animals died with paralytic symptoms, of course, this would go to prove that the dog did not have the rabies. I finding the presumption to be against a case of rabies, concluded that it was not, and thought that we had made an error in the diagnosis. Dr. Spitzka has taken the stand, in his lecture, that they are the symptoms of rabies in dogs, as they occur after inoculation. I think they are not the proper symptoms, and certainly, are not those demonstrated in the Pasteur laboratory.

As regards conclusions and opinions of Pasteur and his work, I was in Pasteur's laboratory for two weeks, and watched his method. I think the question about hydrophobia is yet to be determined, though the evidence, to my mind, is strong and conclusive. His results, so far as I was able to determine, were exceedingly strong. I think he has proven the existence of hydrophobia or rabies in dogs. At all events he has produced some disease not at all like septicæmia, which has a regular incubation, and a peculiar symptomatology.

Dr. Spitzka being invited to close the discussion, did so with the following remarks. I feel indebted to all who have spoken; the majority have not only endorsed my conclusions, but gone much further than the paper in condemning what I venture to regard as a delusion. I am particularly obliged to Dr. Biggs for his candid admission of many facts, which, had I known of them before, I should have incorporated in the paper. All the more do I regret that Dr. Biggs should have discussed the paper under the impression which he seems to have labored under that he was in opposition to its conclusions. It is true that the discussion has taken a direction against the existence of hydrophobia, and against the correctness of Pasteur's views. I cannot regret this, as my private bias of opinion is against the latter. But as I have not ventured to discuss this method in the paper, I claim immunity to criticism. I do not think Dr. Biggs heard the earlier part of my paper, or he could scarcely have gotten the impression that I claimed these dogs to represent true cases of hydrophobia. I so distinctly repudiated the existence of true hydrophobia here, and accentuated the absurdity of Liautard's claim to that effect so strongly that I am surprised at the misconception. I claimed nothing more than to have imitated Liautard's—if you will—*bogus* hydrophobia! That I have most certainly done, and I am pleased to find Dr. Biggs agreeing with me that these symptoms of Dr. Liautard's dog were those of ordinary brain disease and not of hydrophobia. It was to prove this very proposition I read this paper and made these experiments.

As regards the Newark epidemic I must dissent from some of Dr. Bigg's inferences. He speaks of two cases of fatal hydrophobia in residents of Newark, antedating the "scare." In the absence of reliable medical records of these cases, I cannot regard them as anything else than ancient history. To strengthen Pasteur's claims to having cured the Newark children, he says that the two who did not go to Paris were not so severely lacerated by the teeth of the dogs as the others. I believe the general professional opinion to be that wounds bleeding freely are less likely to prove poisoned wounds than slight punctures or scratches which do not bleed freely, and on this score, Dr. Biggs' inference as to the relative immunity of those who remained behind cannot be sustained.

His statements about George Neall, the Newark poundkeeper are exceedinglyly valuable. If we assume Pasteur to be correct, that inoculation of hydrophobic brain and cord will produce hydrophobia in animals inoculated according to this method, then the negative results of Drs. Biggs and Law prove conclusively that George Neall at least had not hydrophobia. If he had not hydrophobia my position that a much larger number of cases of fatal hydrophobia exists than is usually imagined, is fortified by Dr. Biggs' very candid admission.

I cannot agree with Dr. Biggs in his stricture on Dr. Dulles figures. It is true that some of the 907 cases were not from France, but the majority were. His noteworthy conclusion, with a slight change, remains uncontroverted. I cannot censure Dr. Dulles for assuming that Pasteur ignored the fact that only 15-25 per cent. of persons bitten by rabid dogs go mad. Dr. Biggs says that Pasteur is aware of this. If so, there is no indication of it in his proclamations. He uses the expression "I have cured" to the reporter of the *Boston Journal.* He also says—to cover his failures—that the bite of the mad wolf is more fatal than that of the mad dog. To prove this, he picks out some cases running back as far as 1806 and 1788, showing that 100 per cent., or nearly that, of those bitten died. He seems to forget altogether the surgical nature of the wounds. A wolf makes an ugly job of the person he attacks. If he escapes with life he is probable remote from the little hamlet where he resides; hemorrhage is apt to be extensive; the bites are usually inflicted in cold weather, which has a bad effect on wounds, and medical aid is administered late, if at all. Under these circumstances exhaustion, blood-poisoning, erysipelas and tetanus ought not to surprise us.

With regard to Dr. Kretchmar's case, I stated it, to avoid argument, to be one of hydrophobia. Yet is it not strange that this should be the only case in a large city like Brooklyn? I do not think that terror and expectant attention can be excluded. The attack by the second dog so shortly before the fatal issue, was, at least, unfortunate. I will however say, that of all cases reported within the year, here, his is the one which best corresponds to the typical picture described in text books· Dr. Bigg's patient, if I am not mistaken, was regarded as a case of alcoholic delirium.

Dr. Biggs. I suggested that, but was not able to find grounds for the belief.

Dr. Spitzka. I suppose Dr. Biggs was in just such a position as I would be in to-morrow, or in which Dr. Kretschmar was, that of never having seen a true case before, and of being compelled to make the diagnosis from our reading knowledge? (assented to.) I must admit being puzzled by the question as to the existence of the real disease. Those who advocate it are certainly inconsistent in a high degree. The excellent authority whom I quoted: Law, admits that there are no differential criteria, between the real and the spurious affection. Do you know of any other contagious disease which can be so closely simulated? Years ago, when advocating the reality of lyssa in man, in a conversation, I urged its transmission to cattle, as proof that there was an element in it, independant of mental influences. To-day I cannot maintain that, in view of the singular statement reproduced in Law's essay, that the convulsive seizures in herbivora and omnivora, are provoked *by the sight of a dog!*

The fact has been advocated, too, that the discussion was rather one-sided. I must admit that to be true, and no little surprise to myself. I certainly took every measure to ensure the presence of the members of the Pasteur institute, but their leaders have excused their inability to attend on various grounds. They were invited officially, as well as by myself, individually, and the notices of the meeting were abundant, and my intentions known. If I have shown, irrespective of the question of true hydrophobia, that a larger numb r of deaths than the dog is responsible for, are due to terror and expectant attention, and can be avoided by suppressing such inexcusable scares as were started at Riverdale and at New York, my purpose will have been accomplished.

A vote of thanks having been passed, a committee of three was appointed, on motion, by the chair, to further consider the matter and report.

During the reading of the paper, the four dogs, named A, B, C and D, were exhibited, the dog B, particularly showing paraparesis on being urged to jump off a chair, while dog C, showed stupor and manége movement, somewhat hampered by the confined space. The brains of dogs E and F, the latter of whom had died delirious that morning, were exhibited, showing purulent meningitis. Dog A was chloroformed to death by Dr. Hamill, and Veterinary Student Atcheson, and the brain exposed by Dr. Brill. The dura was found to have united in a milk-white linear cicatrix. There was an adhesion to the leptomeninges and a spot of inflammatory red softening, of the size of a three cent piece, deeply extending into the brain substance. A blood clot was found lying further forward, and the entire hemisphere, of the side of the operation (right) was injected and slightly tumefied.

VETERINARY MEDICAL ASSOCIATION OF NEW JERSEY.

The second annual meeting (seventh regular) of the Veterinary Medical Association of New Jersey, was held at the

United States Hotel in Morristown, on Thursday, April 8th, 1886,

The President, Dr. Wm. B. E. Miller, of Camden, occupied the chair and called the meeting to order at 11 A.M., when the roll was called by the Secretary. The following members were present:

David J. Dixon, of Hoboken; L. R. Sattler, of Newark; W. P. Humphrey, of Elizabeth; James C. Dustan, of Morristown; Wm. B. Haydon, of Newark; A. S. Leatherman, of Clinton; Wm. B. E. Miller, of Camden; James W. Hawk, of Newark; Wm. P. Smith, of Trenton; Rudolph Leis, of Newark; L. P. Hurley, of Hopewell, and Wm. Herbert Lowe, of Paterson.

There were also present I. Newton Krowl, D.V.S., of Union Hill; Charles Kuhne, D.V.S., of Jersey City; Willet H. Cooper, V.S., of Salem, and others interested in the advancement of the veterinary profession.

The minutes of the last regular meeting, which was held at Camden, December 10th, 1885, was read by the Secretary and adopted.

The President, Dr. Miller, then delivered his annual address. He congratulated the association on the advancement made in the short time—only two years—since its organization, and especially for that made within the past year, since it became a corporate body. He said that we have now thirty-two active members, and that there are five applicants for admission. He paid a delicate tribute to the late A. P. Weeks, of Paterson, and the late Dr. William G. Schmidt, of Newark. Much stress was laid on the necessity and importance of members attending the meetings regularly; that they should lend their aid individually, as well as generally—that it is very important to obtain "some legislative action that may secure for us recognition, such as a profession so noble as ours is, so well deserving of. Let us use our influence to elect such legislators in the near future as will listen and consider well our appeal for the passage of such laws as will provide for us proper protection. The present status and outlook of the profession shows that there is ample field for well-qualified veterinary surgeons, and that there is now for them, and in the near future still more so, not only honorable recognition, but ample reward. The veterinarian has yet to play a very important part in our large cities, in the inspection of meat, milk, butter and other productions that are daily put upon our markets totally unfit for food. In the extermination and prevention of contagious diseases, in the sanitary work of local and State Boards of Health, so far as they relate to animals, and in some other respects the veterinarian must become better known as a sanitarian. The great money value of the higher breeds of horses, cattle, etc., now render his services indispensable, and of high value. "The call is for more and better educated men," who must be prepared by a thorough course of instruction in a reputable, legally chartered college.

The President also spoke of the present and future usefulness of the Association, and of the great advantage of combined over individual effort. In conclusion, he returned thanks for the honored bestowed and the confidence reposed in him.

He said: "To my assistant officers I return especial thanks for many courtesies and favors received at their hands, and for the faithful manner in which they each and all have performed their several duties. To Dr. Lowe, who was elected Secretary upon the resignation of Dr. Julius Gerth, I am especially obligated. In the discharge of his duties he has proven himself worthy the praises due a competent and faithful officer. It will be to me a life-long pleasure to refer with pride to the associations of the past two years, and they will be cherished with kindly recollections of you all while memory lasts."

The Secretary was reminded that he had omitted to state in the minutes of the last meeting that the names of members in arrears, not paid on or before the next meeting following, would have their names stricken from the roll.

On motion of Dr. Hawk, the Secretary was instructed to immediately notify all members one year or more in arrears, that their names will be stricken from the roll at the next meeting, to be held Aug. 12th, unless the Treasurer, meanwhile, receives the amount due the association.

Dr. Miller proposed the following amendment to the by-laws:

Art. 1, sec. 1. Any member of this association who shall refuse or neglect to pay his annual dues for a period of one year, shall be duly notified by the Secretary of his delinquincy within thirty days thereafter, and if the said member does not pay the same at or before the next regular tri-annual meeting, his name shall be dropped from the roll.

Sec. 2. Any member who shall have been dropped for non-payment of dues, may, upon application made at any regular meeting, be re-instated to active membership on the payment of all back dues and assessments accrued from the time he was dropped, by a two-third vote of the members present at such regular meeting.

The Secretary presented the certificates of membership printed since the association was incorporated, all members receiving them being obliged to sign the new constitution and by-laws.

The following eight practitioners were admitted to membership: I. Newton Krowl, D.V.S., of Union Hill; Chas. Kuehne, D.V.S., of Jersey City; Eldon Loblin, D.V.S., of New Brunswick; Joseph Nayler, D.V.S., of Rahway; Willet H. Cooper, V.S., of Salem, B. F. King, V.S., of Little Silver; T. C. Sandford, V.S., of Asbury Park, and F. W. Hillyard, of Mount Holly.

The Board of Censors reported unfavorably on the application for membership of Andrew W. Axford, of Naughrightville, he not having complied with the requirements of the constitution and by-laws. William S. Stone, of Chatham, went before the Board of Censors, but failed to pass a satisfactory examination. Application for membership was made by John Kehoe, of Lyndhurst. The Board of Censors will act on his case at the next meeting, provided he appears for examination.

Dr. Lowe spoke at some length of the defects of the present U. S. Army Veterinary service, but owing to the pressure of business, resolutions which he wished to have passed were laid over to be considered at the next meeting.

Dr. Lowe read a letter from the eminent veterinarian, Dr. George Fleming, of England, but which did not bear upon the business of the society. These words: "Give my heartiest good wishes to your worthy President and to the members of your association," etc., led to remarks by Dr. Lowe on the life and writings of Dr. Fleming, which were very kindly and heartily received. In conclusion, Dr. Lowe proposed Dr. Fleming for honorary membership. He was unanimously elected with marked demonstrations of good will by the assemblage.

Dr. Hawk was of opinion that great vigilance should be used by the association in discovering irregular behavior on the part of any of its members or any practitioners outside of it, with the view of denouncing the same, so that in their everyday practice practitioners shall be obliged to pursue an honorable course towards each other, and those for whom they render service.

Dr. Hayden endorsed the views of Dr. Hawk.

Dr. Krowl did likewise, adding that had he not been highly pleased with the new code of ethics of the association, he would probably not be a member—that he would very much prefer to deal personally with the questionable behavior of some practitioners all alone, than to have the name of the assistance of the association, unless the code of ethics should be fully enforced.

Remarks were also made by Drs. Cooper and Miller, which, in the main, coincided with those already expressed.

Some members were of opinion that there should be uniform rates of charges for certain special kinds of service, but the idea generally prevailed that there were comparatively few which might not be so modified by circumstances as to render it impossible to be governed by rules applicable in all cases.

All the officers of last year were re-elected, with the exception of the Treasurer and Board of Trustees. The officers are: Dr. William B. E. Miller, of Camden, President; Dr. David J. Dixon, of Hoboken, 1st Vice-President; Dr. Charles K. Dyer, of Mount Holly, 2d Vice-President; Dr. William Herbert Lowe, of Paterson, Secretary; Dr. L. R. Sattler, of Newark, Treasurer; Board of Trustees—Dr. Willet H. Cooper, of Salem; Dr. John P. Smith, of Trenton; Dr. James W. Hawk, of Newark; Dr. A. S. Leatherman, of Clinton; Dr. I. Newton Krowl, of Union Hill.

The President appointed Drs. Sattler, Leatherman and Leis, delegates of the United States Veterinary Medical Association, also to the New York State Veterinary Society, and the Pennsylvania State Veterinary Medical Association.

Drs. Dixon and Krowl were appointed essayists for the next regular meeting.

An excellent dinner was served to the members of the Association at the hotel where the meeting was held. Several after-dinner speeches were made, but the most interesting was that by Dr. David J. Dixon, member of the New York State Veterinary Society, and 1st Vice-President of our Association. He entertained all present very happily by his remarks on both societies.

The next regular meeting will be held at Long Branch the second Thursday of August next.

William Herbert Lowe, D.V.S., *Secretary.*

THE NEW YORK STATE ACADEMY OF VETERINARY SCIENCE AND COMPARATIVE PATHOLOGY.

During the past season the Academy has made very good progress in membership, in the choice of which it is very select.

No meeting of the Academy passes without interesting matter for debate, and subjects are brought up from time to time, which are not only interesting to every member, but to the public as well.

In this respect, questions are often asked by those not members, which give rise to useful and important discussion. Recectly, Mr. Henry Bergh, President of the American Society for prevention of cruelty to Animals, sent in the transcript of a letter, which he had previously sent to the *press*, on the question of "Hot Shoeing for Horses," or applying the shoe hot to the horse's foot while fitting.

The President then introduced Dr. Robert Ward, F. R. C. V. S., State Veterinarian of Baltimore, Md., who addressed the meeting with reference to the Code of Ethics relating to Veterinary Medicine, contrasting what is in existence with what ought to be; expressing his views by stating that he was ever willing to accept or recognize any graduate of any legitimate school who was a gentleman. The speaker said unfortunately that there were graduates from some schools who were not always gentlemen.

The doctor then entered on the subject of "State Medicine," or *Preventative Medicine*, which he said hardly, or rather did not exist in this country, and asked whether any member present had ever heard of the Veterinarian having been called upon by the State to prevent the breaking out of contagious diseases?

This was of the utmost importance to the State, and the prevention of contagious diseases was where the higher duties of the Veterinarian were most needed by the community at large, because he had not the slightest doubt but that many thousands of human beings die annually from using the milk and flesh of diseased animals. And while we hear very often of Boards of Health enforcing laws against the spread of disease, and the "stamping out" process, yet we never hear one word about the prevention of disease, while here is the field for the scientific work of the Veterinarian and Physician. And the State should see to it that such work should be entered upon at once, as the best, and in fact the only means to preserve the State from a possible future loss due to animal plagues.

The doctor then described in detail the different contagious diseases to which live stock are subject, particularly such as become epizootic in character, viz.: Contagious Pleuro-Pneumonia, Tuberculosis, Anthrax, Hog Cholera, and even Chicken Cholera. Glanders also came in for a share of comment. He quoted several authors, particularly the great sanitarian Fleming, and the able Professor Walley, on the system of inoculation to prevent the outbreak of contagious diseases, especially Pleuro-Pneumonia in cattle, and paid tribute to Pasteur in his investigations.

The doctor was of the opinion that inoculation might be carried considerably further.

A difference of opinion does exist in regard to the use of the milk and flesh of animals affected with contagious Pleuro-Pneumonia, some authorities claiming it to be harmless, while that of an animal affected with Tuberculosis is admitted by all to be dangerous, it being comunicable to mankind.

Dr. Ward went still further, and stated that the "flesh of any animal affected with any disease in which the blood was improperly decarbonized, was unfit for human food."

During the discourse he exhibited some elegant colored drawings of Pathological specimens of the blood, lungs, kidneys, etc., etc., of animals suffering from the afore-mentioned diseases, many of the drawings were original, and others were from slides taken from the laboratory of the "Johns Hopkins University," Md. Beautiful specimens of the Bacilli and Microbes peculiar to contagious diseases were plainly presented, but in some cases the question arose whether they were the cause or result of the disease.

Dr. Ward's paper called forth considerable discussion.

Dr. Gotthiel said, an animal showing symptoms of any disease, whether before being slaughtered, or after, was not fit for human food, and should be condemned by the inspectors; this should be made compulsory by law. In this he was supported by nearly every member present.

Dr. Earl warned the Academy to be very careful about advocating *law* on this subject, as statutes to this effect would cut off a vast supply of flesh, which, even under suspicious circumstances, made very good food, when *properly cooked.*

Dr. Hamill said that was a question for the political economists. As a scientific body the Academy could only take up the question "Was diseased animal flesh fit for human food?" and while agreeing with Dr. Earl, in regard to the evil of lessening the supply, he believed it was not fit.

Drs. Gottheil, Heard and Meyer sifted through many authorties on this point, showing that there are stages in most all diseases, when there was little or no danger to be apprehened, but the above gentleman claimed better *no* flesh meat than diseased meat.

The following resolution was unanimously adopted:

RESOLVED, that this Academy advocate the passage of proper laws for the establishment of public Abattoirs, where, under the observation of *properly qualified inspectors*, all animals to be used for human food, must be slaughtered.

And further, that all animals found suffering from anthrax, tuberculosis, actinomycosis, trichinoses, hog-cholera pleuropneumonia, and chicken-cholera, should be *entirely excluded* as unfit for consumption.

It was then moved and seconded that a vote of thanks and the support of the Academy be tendered to Dr. Ward, in his noble efforts to elevate the Veterinary profession in America.

COMMENCEMENT OF MONTREAL VETERINARY COLLEGE.

The final examinations, before a board of examiners appointed by the council of agriculture, took place in the college lecture room Tuesday morning. The board was constituted as follows: Messrs. Wm. Bryden, V.S., Boston, Mass.; Frank S. Billings, M.V., Roxbury. Mass.; Archibald McCormic, V.S., Ormstown; Charles C. Cowie, M.R.C.V.S., Ogdensburg, N. Y.; J. A. Couture,

V. S. Quebec; A. W. Harris, V.S., Ottawa; A. E. Cross, V.S., Montreal; Charles Levesque, V.S.. Berthier (en haut). The following gentlemen having passed all the examinations and attended the prescribed number of sessions, were considered by the board to be fully qualified to practice the science and art of veterinary medicine and surgery, and were judged worthy to receive the diploma of the college: Messrs. Wroughton, Whyte, Dyer, and Sangster.

The presentation of prizes and diplomas took place in the afternoon, Sir William Dawson, the principal of McGill university presiding. There was a large attendance of the friends of the college and students. Dr. Leclerc, secretary of the council of agriculture, read the report of the result of the various examinations and prizes. The chairman then presented the prizes to the successful competitors, and presented the diploma of the college to Messrs. T. A. Wroughton, C. C. Dyer, J. D. Whyte, and G. W. Sangster.

Sir William Dawson said though the number receiving diplomas was small, those who had received them might be congratulated on having gone through a most thorough course, for which they were greatly indebted to their instructors. It was a most fallacious method to judge a school by the number of its graduates. He hoped the time would come when, through Government aid, this school would cease to be a burden on its principal.

Mr. Blackwood, representing the Quebec Council of Agriculture, said that during the year he had had occasion to examine into the condition of the men who had been educated at this college. and he was gratified to learn that every one whom he had been able to trace had been successful. This was a remarkable record and an encouraging outlook to those now leaving the college. to whom as an old man he might be permitted to give one or two bits of advice. Certain temptations peculiarly surrounded the members of their profession. Let it be said of each of them, as he had once heard it remarked of their principal, that no money could affect his opinion of a horse; and let them be careful about drink, which it would be hard for them to avoid. He had himself in 1836 come to the conclusion that his only safe course lay in total abstinence, which course he had never departed from.

Dr. Billings, one of the examiners, had one thing to add to what had been said, and that was, if there was anything worse than rum it was the horse man. The veterinary surgeon who had his office in a stable and who spent his spare time in talking horse slang and soiling the floor with tobacco, disgraced his profession. The man who courted his clients in this way got the worst of it, while he who took the place where he belonged, at a respectable distance from them, would be respected by them. Dr. Billings ascribed to Principal McEachran the very first place on this continent as a veterinary surgeon and veterinary educator, and denounced the diploma mills and cheap subscription societies that passed for veterinary colleges all over the continent. He hoped to give his friend a race for the first place in the school about to be established by the State of Nebraska, He urged upon all students and graduates to devote themselves to original investigation. It was original investigation that gave to Virchow the proud distinction which he enjoyed.

Dr. Hingston, in adding his quota of advice to the young men, said it was their duty to take the position of gentlemen among society and to uphold the dignity of their profession by their demeanor as well as by their acquire-ments. He quoted some eminent examples of veterinary men who took the highest social places.

Dr. McEachran endorsed the advice that had been given them, as well as what had been said of the success of the graduates. A number of these now held teaching positions, and although from his experience he could not recommend this occupation as a money-making one, they could at all events assure themselves that those who had passed through the course prescribed by this college were qualified to teach.

The proceedings were then brought to a close.

The Montreal Veterinary Medical Association afterwards held a meeting for the purpose of conferring on the successful graduates the diploma of the association. In presenting them, the president, Dr. Baker, warmly congratulated the young men, saying he hoped they would always consider it an honor to possess these diplomas, and that the association would always be equally proud of the honors.

Mr. Feron was then elected to fill the offices of secretary-treasurer and librarian during the summer, after which the meeting adjourned.

Progress of Veterinary Science.

RESEARCH INTO THE UNION. OF TENDONS Mr. R. W. Parker and Prof. Horsley, have been investigating the question whether perfect reunion of tendons can occur when the ends are separated as far as possible. This question is one of very considerable practical surgical interest, in connexion with the orthopædic replacement of distorted parts, since it has been till the present time a matter of dispute whether the method of putting up a limb operated upon by tenotomy in a position of complete extension is or is not justifiable. As such a method presents many advantages over the older and more gradual treatment it seemed to Mr. Parker that the question ought to be decided by definite experiment.

Prof. Horsley divided the Achillis tendon in four dogs by the usual subcutaneous proceeding, and then fixed the limb in complete flexion by a suitable immobile splint of collodion and gauze. The animals being etherized, suffered no pain from the trifling operation, etc. A careful examination, both macroscopic and microscopic, by Mr. Parker, has in every case revealed the important fact that complete reunion of the tendon subsequently occurred, so that the point in question may now be considered as definitely settled in favor of the rapid method of treatment referred to above. The details of the above experimental results will be published shortly by Mr. Parker.

COAGULATION OF THE BLOOD.—Dr. Wooldridge has been engaged on the study of this subject.

The results obtained have been communicated to the Royal Society, and are partly of such a nature as not to permit of an abstract being given.

Perhaps the most interesting result obtained has been the Isolation of a Substance from perfectly fresh Animal tissues, the injection of a solution of which into the blood of an animal causes instant death.

The most convenient sources of this substance are the Testes and Thymus gland of the Calf; but it also occurs in other tissues.

It causes death by producing intravascular fibrinous coagulation. Thus, into the jugular vein of a rabbit, a solution containing about ½ gram of the substance was injected. The animal died within a few seconds, and the whole vascular system was completely thrombosed, both sides of the heart being completely filled with clot, as was the case with the Aorta, Vena cava, Vena porta, all the mesenteric Veins, Carotids, Iliacs. etc.

This result is not due to the admixture of any fibrin ferment with the substance. The latter is a proteid body in combination with Lecithin: it entirely loses its power by being subjected to action of artificial gastric digestion for two or three hours.

The action of the substance is perfectly constant, the extent of the intravascular clotting depending on the amount of substance injected, so that a certain dose is necessary in order to kill.

It is singular that in dogs a moderate dose causes death by Thrombosis of the portal vein, this being a perfectly constant lesion, the sudden plugging of this vein giving rise to a fatal fall in blood-pressure.

In addition to causing intravascular coagulation the substance prevents he coagulation of shed blood,—that is to say, blood drawn off, after injecion of a moderate quantity, remains fluid for a very long period, ultimately, however, clotting.

There is reason to hope that this substance may be made practically useful, and full details will appear shortly.

RESEARCH INTO THE FUNCTION OF THE THYROID GLAND.—In December, 1884, Prof. Victor Horsley showed that the thyroid gland was intimately connected with the process of mucin metabolism, that if the thyroid gland in monkeys was removed with antiseptic precautions (the same ensuring healing of the wound in three days) the consequences to the animal were—(1) symptoms of general nervous disturbance evidenced by tremors, paroxysmal convulsions, functional paralysis, mental hebetude, and finally complete imbecility; (2) profound anæmia coupled with leucocytosis; (3) all the symptoms of the disease discovered within the last decade and termed myxœdema; (4) that just as in the acute form of the disease just named there was found to be a great accumulation of mucin in the connective tissues throughout the body (mucinoid degeneration) and in the blood, and as a consequence the same post mortem appearances; (5) that at the same time there was a great activity in the mucin-secreting glands, and, further, that the parotid gland under these abnormal circumstances secreted mucin in large quantity, the gland-cells at the same time disintegrating.

During the past year I have confirmed my previous observations and greatly extended them, and have firm basis for my original opinion that the function of the thyroid gland is indispensable to the higher animals, and that it is duplex in function, since in the first place, it regulates the formation of mucin in the body; and, in the second place, it aids in the manufacture of blood-corpuscles. My researches during the past year (1885) have been directed towards the investigation of (1) the circumstances which influence the course of the extensive disturbance of general nutrition which follows the loss of the gland; (2) the direct effect of the said fall in nutrition upon the nerve-centres; and (3) the hæmapoietic function of the gland.

(1) I find that the determining factor par excellence of the value of the gland as regards its influence on the general metabolic processes of the animal is age. The effect of removing the gland in the young animal is the rapid appearance of violent nerve-symptoms and death in a few days; in a rather older animal, *i. e.*, a one-year old dog, the symptoms are less violent, later in their appearance, and the animal survives perhaps for a fortnight or three weeks; in a very old animal the removal of the gland simply hastens the torpor of old age; these observations refer to dogs and cats. In the higher animals, monkeys, the operation on a young individual produces the same result as in a young dog, but, as I showed last year, an older animal, if kept under ordinary circumstances, will survive for six or seven weeks, dying at the end of that time of myxœdema. On the whole, therefore, it appears that the thyroid gland is of extreme importance when tissue metabolism is most active, and that it diminishes in value as the senile state advances. Huschke has shown that the relative weight of the thyroid body to the body-weight is greatest at birth, that it rapidly diminishes during the next few weeks, and that it steadily decreases as age advances. Finally, the structural degeneration of the gland in old age is well known. It is clear, therefore, that the gland plays an important and constant part in the metabolism of the body: I desire here to draw special attention to the fact that the symptoms of old age, namely, wasting of the actively functional parenchymatous tissues, atrophy, and falling out of the hair, decay of the teeth, dryness and harshness of the skin, tremors, etc., are exactly the most prominent features of the myxœdematous state, whether it occurs naturally in the human being, prematurely, as in cretinism, or artificially, as in my experiments on monkeys. It is, perhaps, well to remark here that, as might have been foreseen, the previous state of nutrition of the body determines to a large extent the rapidity of onset and the course of the symptoms.

The next circumstance of extreme importance which influences the course of the symptoms is the Temperature at which the animals are kept after the gland has been removed. I showed last year that one of the most striking features of the fall of nutrition which follows the loss of the gland was a steady diminution of the body heat. this suggested to me a line of research which has yielded a striking result. I have kept another series of animals (on whom I have performed thyroidectomy under the conditions above stated) at a constant temperature of 90° F.,* and when they exhibited any nerve-symptoms, *i. e.*, tremors, etc., placed them in a hot-air bath at a temperature of 105° F. The effect of this has been to lengthen the duration of life (in all but very young animals) four or five times the extent of that observed in the first series. Instead of living four to seven weeks they now live as many months. At the same time several additional facts of importance are noted, and the symptoms before referred to are so modified as to require the addition of a third stage of the two described in 1884. (These observations refer solely to monkeys). The animals kept under the extra high temperature above noted thus pass through three stages—1. neurotic; 2. mucinoid; 3. atrophic. I have said that the neurotic stage under these circumstances may be scarcely marked, or if the nerve-symptoms occur, and the animal be put in the hot-air bath, they soon disappear. Next, the animal lives through the mucinoid stage, *i.e.*, myxœdematous condition- and arrives in the third stage, the atrophic. Now, the symptoms of the second stage are just as much subdued as those of the first; there is no excessive secretion of mucus, the parotid glands do not swell, and the post-mortem examination does not reveal the extensive mucinoid degeneration observed in the first series. Finally, the third, atrophic, stage into which the animal passes is evidenced by great emaciation, functional paresis and paralysis, imbecility, falling blood-pressure and temperature, with death by coma.

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*In my first experiment, (1884), the animals were kept at a temperature varying from 60° to 70°, F.

I am disposed to regard this fact of the animals passing through these neurotic, mucinoid stages, and dying at the end of the atrophic, as the key to the observation that cretins in whom the thyroid gland is very slowly destroyed, and very chronic cases of myxœdema do not exhibit much mucinoid degeneration.

(2), I will now briefly enumerate the direct effect of the fall of nutrition produced by the loss of the thyroid gland on the nerve-centres: *a*. Effect on cortex. The tetanus * obtained by stimulating the cortex is remarkably changed (even as soon as one day after the thyroidectomy in a dog, which exhibited violent symptoms in twenty-four hours) by the fact of the fall (when the current was shut off) being as sudden as that observed on stimulating the corona radiata. Next, that the tetanus in a more advanced case is soon exhausted, the curve approaching the abscissa soon after the initial rise; at the same time the curve is followed by clonic epileptoid spasms, which, however, are soon exhausted. Stimulation of the corona radiata and spinal cord also gave the customary tetanus, which, like that of the cortex, was rapidly exhausted. These stimulations of the nerve-centres suppressed the thyroid tremors just as voluntary movements do. Another evidence of the changes in the cortex is the frequency with which continuous stimulation will evoke the appearance of clonic spasms on the original tetanic curve, the latter not being followed by epilepsy when the current is shut off.

(*b*). Effect on the spinal cord. The tetanus obtained by stimulation of the spinal cord, like that of the cortex, rises slowly to the highest point, and then steadily falls towards the abscissa although the stimulation is maintained; and when the current is shut off the muscle completely relaxes, having absolutely lost its tone, and this tonic paralysis is not recovered for from 10 to 15 seconds. Stimulation of the spinal cord to fatigue, after some time has elapsed so as to produce exhaustion of the preliminary tetanus, evokes a tremor of eight to ten per second.

Tracings from an old animal (cat) which had survived the operation some months, and also from a dog and monkeys, in which case the symptoms had been very severe for some days, exhibited only a very feeble tetanus in the

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† Graphically recorded according to method described by Prof. Schafer and myself. ("Proc. Roy. Soc.," Dec. 10, 1885).

former instance, and practically no reaction at all in the latter; this being the ultimate state of depression of function which the nerve-centres had arrived at.

(3) I have thought it as well to add to the anatomical and physiological proofs I gave last year of the thyroid gland being a hæmapoietic structure by counting the number of corpuscles in the blood of the thyroid artery and vein respectively. After discounting any possible alteration in the relative number of the corpuscles in the two vessels by changes in the fluid constituent of the blood which may have happened in the gland, the much greater number of corpuscles in the vein (x 7 per cent.) confirms the deductions drawn from my previous observations.

To sum up: the function of the thyroid gland appears to me to be twofold, as already suggested, viz.: (1) Control of mucin metabolism; (2) Hæmapoiesis. The metabolic processes in the body may be regarded broadly as resulting in Construction and Destruction. The products of destruction are the waste-products of tissue change, and being, as such, harmful to the organism, are cast out by the excretory organ. It appears to be that the thyroid gland aids in excretion of mucinoid substances or their precursors, not of course by excretion properly speaking, that is, casting them out from the body, but by metamorphising them into some other form which is useful to the system. That this process, whatever it is, is of vital importance to the young mammal (seeing that interference with it causes death in a few days) is obvious, and such as it is, the loss of it is distinctly connected with the appearance of the disease known as myxœdema, cretinism and senile degeneration. Finally, this defect in the circle of metabolism determines the appearance of so-called functional disorders of the nervous system.

RESEARCH INTO THE PATHOLOGY OF THE DISEASE IN DOGS, KNOWN AS CANINE CHOREA, A SEQUELA OF DISTEMPER. By Prof. V. Horsley.—Up to the present time much information has been collected concerning the Pathological Anatomy of this condition, but owing to each observer having but two or three animals to examine, such information has been of but little value, owing to wide discrepancies between the results as published by the different investigators. Besides the obvious importance of deciding, if possible, this debateable point, it seemed to me extremely important to investigate closely the Pathology of the Nerve-Symptoms of this disorder by the most recent methods. From a number of experiments (seven) I have confirmed the observations of previous workers to the effect that the disorder of mechanism is situated in the spinal cord, and have further established the accuracy of this opinion by showing that the artificial restoration of the tonus of the muscles does not reproduce the rhythmical twitching. I have also shown that the influence of the higher centres upon the lower is, to a considerable extent, elucidated by the stimulation (for method see below) of various portions of the motor tract in this disease from the cortex downwards. From the experiments it would appear that the influence of the cortex upon the spinal cord is to increase (double) the rate of rhythmical discharge in the latter without, however, increasing the force of the latter at all, consequently, that the rate being doubled, the energy of each discharge is halved. In addition to this fact I have noted others of a similar nature (published in detail in the "Brown Lectures," 1885), which illustrate the interaction of the disorganized nerve-centres. The second half of the investigation (namely, the anatomical portion) has resulted in establishing harmony between the discrepant observations before referred to, by showing that the different appearances seen by various observers were really successive stages of the malady. From examination of very severe cases I have been able to go further than this, and I have demonstrated that the final stage of the "inflammatory" condition of the spinal cord is sclerosis, and sclerosis identical in every respect with disseminated sclerosis in man. I may be, perhaps, excused if I here point out that the significance of this fact lies in the demonstration that sclerosis may be the final stage of an "inflammatory" condition.

The methods referred to above were the same as those described by Prof. Schafer and myself in the "Proc. Roy. Soc.", December, 1885.

DISEASE OF THE CIRCULAORY ORGANS IN ANIMALS.—Mr. Bland Sutton read a paper before the Pathological Society of London, giving a brief account of the various diseases which affect the organs of circulation in animals. Lesions of the heart and vessels were by no means of so frequent occurrence as in man—indeed, they were comparatively rare.

. Inflammation of the pericardium arose from much the same causes, and presented similar characters to the same disease in man. It might arise from injuries, extension from pleurisy, simple or tubercular (perlsucht), parasites and rheumatic fever (?). It was well known to veterinarians that horses suffered from rheumatic fever and that pericarditis was a frequent complication. Mr. Sutton was strongly of the opinion that mammals which frequent the water, such as the hippopotamus, beaver, otter and others, suffered from this disease. It was in these animals that most of the uncomplicated cases of pericarditis occurred, and many days before death they lie about, abstain from entering the water, and when stirred, manifest signs of pain. Of the different varieties of pericarditis, specimens were shown from a lizard and a peacock (parasitic); from a beaver, an antelope and a monkey (rheumatic); from a tiger, coatimundi, etc., arising from extension, and one specimen from a monkey where the pericardium was enveloped by a mass of lympho-sarcoma, giving rise to effusion into the pericardial cavity. It was interesting to note, according to Rayer, that Galen described the first case of pericardial effusion, and that it occurred in a monkey. The most interesting cases of traumatic pericarditis were chiefly found in cows. When cropping the grass these animals frequently took up foreign bodies, such as pieces of wire, needles, etc. These sharp bodies were checked by the psalterium, and diverted from their course; they might pierce the coats of the stomach, pass through the diaphragm, and enter the pericardium, where they gave rise to violent inflammation. This condition was well known to veterinary surgeons.

The milk-white patch was very frequent in some birds and monkeys as a consequence of pressure from rickets, but the deformity induced by the latter disease led to a very serious condition of the heart. which might be best termed "flexion." If a young monkey who had died from rickets be frozen and vertically bisected, it would be found that the spinal column was in a condition of curvature (cat's back); this was often so severe that the sternum also became flexed, and a "knuckling" took place and squeezed the heart between the spine and sternum, and flexed it. This led to atrophy of the wall of the right ventricle, and in some cases this was so marked that the outer boundary of the cavity only consisted of the visceral layer of the pericardium. The condition would probably be found in children if carefully looked for in extreme cases of rickets.

Affections of the valves, endocarditis, vegetations and calcifications occurred occasionally, leading to incompetency and its consequences. Specimens were exhibited from sheep, Coypu rats, deer, antelopes, buffalo and a bear.

Diseases of the vessels were exceedingly rare, atheroma was found fairly often in the posterior aorta of the horse, and verminous aneuryism occurred in probably 90 per cent. of adult asses; excluding these examples, diseases of the vessels were exceedingly rare. Among the very great number of wild animals examined, twice only was atheroma detected—in a buffalo and in a zebu, the sacred ox of India. As a consequence of this, true aneuryism was very rare, and Mr. Sutton only knew of about three genuine cases in wild animals.

Verminous aneurism, although so common in asses and fairly frequent in horses, was yet confined to the domesticated animals; he had not found it in any of the wild members of the group. Fortunately the disease did not affect man, and this explained the little interest it excited in the medical profession, although the presence of these worms in the tunic of an artery was known to Ruysch as far back as 1665.

The last affection to notice was arterio capillary fibrosis, which affected the medium-sized arteries of the horse and cattle, and, as in man, was associated with chronic interstitial nephritis. Perhaps the most interesting fact in this connection was that which indicated the rarity of atheroma in animals. It had been noted previously by writers, but few had adduced any number large enough to make a generalizatian. The infrequency of the disease may be due to the abscence of alcoholism, syphilis and arterial strain.—*Veterinarian.*

NEPHRITIS IN LAMBS.—At a meeting of the Pathological Society in London Mr. Roger Williams exhibited specimens of acute nephritis in Lambs. The disease began soon after birth with difficulty in walking, the new-born falling down and lying on one side, sometimes with choroid movements, without loss of consciousness, without difficulty in breathing or cough; sucking was not impaired, nor the appetite. The disease appeared to attack the lambs of ewes imported from Scotland, and especially those whose female parents were served by a ram who was far from vigorous, having to spend his strength on too many ewes. At all events, it was found that if a ram only served ten ewes the progeny were vigorous, and did not become affected with the disease. Mr. Williams had examined two lambs, one that died of the disease and another killed at three weeks old. The urine was albuminous and acid, whereas it should have been alkaline. There were no renal casts, crystals, pus or blood. The capsules of the kidneys stripped off easily, exposing a surface studded with congested stellate veins. The cortex was swollen and soft, pale and yellowish in color, whilst the pyramids were firm and deep red in color. The disease was an acute tubal nephritis; the tubular epithelium was much degenerated, not staining with log-wood, whilst the interstitial tissue was normal. The changes in both cases were identical, though one was in a more advanced condition than the other. Nothing abnormal was detected in any of the organs, and the spinal cord was healthy. Some of the lambs were born with the disease and soon succumbed. Dr. Pye-Smith said the normal reaction of lambs' urine whilst suckling was acid.—*Veterinary Journal.*

REVIEWS.

First Annual Report of the State Board of Health, of the State of Maine, for the year ending December 31st, 1885.

Augusta, 1886.

The act to establish the above Board, was approved on February 27th, 1885, and the following members appointed: Frederick H. Gerrish, M D., President; A. G. Young, M.D., Secretary; Hon. Lewis Barker, Hon. Stephen J. Young, O. A. Horr, M.D., E. C. Jordan, C.E.. J. O. Webster. M.D.

The first meeting was held April 13th, of the same year. Six meetings have already been held, and the amount and character of the work performed, as shown by the Report, speak well for the intelligence and energy of the Board, and promises for the State an improved sanitary condition for the future.

Circulars relating to the restriction and prevention of contagious diseases have been published and circulated extensively, especially on cholera, typhoid fever, diphtheria, scarlet fever and small pox. Also on the building and ventilation of school-houses.

A full account of the small pox epidemic in Montreal, is given, and the protective measures there adopted.

A very important and interesting work established by the Board, was the sending out of letters of inquiry to all the physicians in the State, regarding the topography and epidemiological conditions of their localities. The results, as is shown by the reports from their correspondents, proved of great value. Interesting accounts from the older members of the medical profession, of the prevalence of cholera, yellow fever, etc., will be found amongst them.

There seems to be considerable difference of opinion, in regard to the contagiousness of diphtheria. On this point, Dr. Morton, of Bethel, gives testimony in its favor. He says: "I think that sufficient notice is not taken of the part that *cats* and *dogs* play, in the spread of this disease. These animals have free access to children sick with the above disease, and they prowl for miles from home, carrying the poison germs in their hair, and in their plays and fights communicate it to other animals, who convey it into their families, and are carressed and handled by children, and they become victims to those diseases, and people are at a loss to know how they became thus affected."

An Augusta physician relates that about a year ago the pet kitten of one of his children became sick with what appeared like diphtheria. There was no other case, nor had been lately in town.

Apropos of this subject, Dr. Jacobi gives an account of a diphtheria epidemic in a hen coop. "Twenty-six hundred hens were imported from Verona, Italy, into a village, Messelhausen, in Baden, Some of these hens were affected with diphtheria when they arrived. Within six weeks six-hundred of their number died of diphtheria, and eight hundred more soon after. In the following summer, one thousand chickens were raised by artificial breeding, all of which died of diphtheria, within six weeks. Five cats kept in the place also died of diphtheria ; a parrot fell sick with it, but recovered. Besides, four of the six working men, employed in taking care of the hens of the establishment, were taken sick with diphtheria. Not a single case, however, occurred in the neighboring village. Thus, it is safe to assume that the diphtheritic disease of hens can be transmitted to man."

As regards the contagiousness of consumption, the correspondents, in a large proportion, have decided convictions in its favor. The opinions of the Veterinarians tend to the same belief. By way of prophylaxis banishment to hospitals is condemned as cruel and unnecessary. Destruction of the sputa, general cleanliness and proper ventilation are the means suggested. The patient should always sleep alone. Under these circumstances the danger of contagion is slight.

Several special papers of interest, relating to sanitary matters, are to be found at the end of the Report. Dr. Gerrish, the President, gives a condensed account of the work accomplished by the the American Public Health Association. Mr. Jordan shows how death rates are affected by defective plumbing and sewerage, and Dr. Horr tells all there is to be known on vaccination. The system of local Boards in towns and cities, and their importance, is from the pen of Dr. Webster.

A glossary is appended so that the general public will find no stumbling blocks in the shape of unknown technical terms.

On the whole, the Report is the most complete we have yet seen, and we recommend its careful perusal to those in other States, who have in view the formation of similar institutions. J. O. L.

OSSERVAZIONI ANATOMISCHE, del. Prof. Lombardini. Sull 'utero di cavalla nei primi mesi della gravidanza.

In this pamphlet the author gives some exceedingly interesting descriptions of the anatomy of the uterus of the horse, during the first months of pregnancy. It contains five illustrations, showing the histology of the corion placenta, etc. The observations made thereon, will be found of great value to the Veterinarian who makes a special study of obstetrics.

In relation to the bare spaces of the placenta, which Turner has found in the whale, Eschricht in the common seal, and Horne in the Malayan tapir, he says that they are not mentioned by those who have studied the equine uterus, and relates that in 1880 he had occasion to examine the uterus of a horse, in the seventh month of pregnancy. To the naked eye the crypts appeared to have been arrested in their circumference, forming a clean border. On microscopical examination, however, it became manifest that they were portions of the mucous membrane, in which the placental follicles were incompletely developed.

OUTLINES FOR A MUSEUM OF ANATOMY, prepared for the Bureau of Education. by Dr. R. W. Shufeldt, U.S.A., Washington, 1885.

This pamphlet is well worth reading by any one interested in the subject of which it treats, but especially so by the veterinarian and the student of comparative medicine.

Dr. Shufelt starts out with a general condemnation of the few anatomical museums in this country, as they are now conducted. There is no system, he says, in the arrangement, and the specimens are almost useless. He considers vain, all the labor expended on dried, dissected preparations.

He gives an idea of what a model museum should be, and in stating the laws which should govern its formation, he reiterates a truth, often expressed in the pages of this Journal, viz.: that *progress in medicine and surgery is in proportion to the advance made in the knowledge of the Anatomy, Physiology and Pathology of the lower animals*

He thinks that the law of evolution should be kept in view in the arrangement of the museum, and that the classification of its specimens should tend to its illustration. Each specimen should occupy its proper place, and should not be considered merely as an object of curiosity.

Classification of the forms of the animal kingdom are explained, methods are suggested for the exhibition of anatomical subjects, and rules laid down to best enable the student to study the grand principles on which morphology, the "back-story" of medicine is founded.

EDUCATIONAL MUSEUMS OF VERTEBRATES. An address before the Section of Biology, of the A. A. A. S., at Ann Arbor, August 1885. By Burt G. Wilder, M. D., Vice-President.

"Order is Heaven's first law," and Dr. Wilder believes that this law should prevail in terrestrial as well as celestial affairs, especially in the arrangement of museums of Vertebrate animals, one of which should be found in every educational institute.

He thinks an institute of this character should not only exhibit *facts*, but also illustrate *ideas*, and explains the methods employed in the collection at Cornell University, the specimens in which are arranged in harmony with the law of evolution. Such work, in his opinion, would be a more appropriate memorial of the immortal Darwin, than the statue which had been recently dedicated to him in London.

GLOVER'S ALBUM. A treatise on canine diseases. By H. Clay Glover, V.S.

Ofconvenient size to carry in the pocket, this little book will prove of great value to owners of dogs.

The diseases common to these animals are described, and the treatment explained, while some excellent formula are added. The portraits of the most prominent dogs are also to be found in it. We recommend it to all who would keep their canine friends in good condition.

THIRTEENTH ANNUAL REPORT OF THE NEW JERSEY STATE BOARD OF AGRICULTURE, 1885.

In this volume is to be found the reports of the State Veterinary Inspectors, in which inoculation of cattle suffering from pleuro-pneumonia, is found of great value as a preventive measure.

It demonstrates that immediate destruction of the affected animal, is the only remedy in cases of glanders. Attention is called to necessity of more stringent laws to regulate the meat and milk traffic of cows affected with tuberculosis. Dr. Wm. H. Lowe, in his report, says: "Pleuro-pneumonia principally involves a question of property and its money value, but tuberculosis, that is, if it be communicable to the human subject, through the milk and meat of tuberculosis animals, as many eminent scientists now claim, has a significance of vast and wide-spread importance. As the law now stands, there is no authority by which tuberculos animals can be destroyed, and yet, considering the prevalence of the disease, and its devastation, it is a question whether any of the other contagious diseases are worthy of more attention, or stricter legislation than tuberculosis."

The same inspector reports a case of actinomycosis, and also gives an account of a strange case in Passaic city A number of cows became sick, and the disease was variously pronounced as meningitis, enteritis, &c. Dr. Lowe diagnosed lead poisoning, and his opinion was justified by the finding of a number of paint pots and brushes in the pasture grounds. In regard to rabies, he thinks that whatever may be the results of Pasteur's investigations, the importance of prevention cannot be underated.

BOOKS AND PAMPHLETS RECEIVED.

STUDIES FROM THE BIOLOGICAL LABORATORY, JOHNS HOPKINS UNIVERSITY, Baltimore. Edited by H. Newell Martin, M. D., F. R. S., and W. K. Brooks, Ph.D. Vol. III., Nos. 5, 6 and 7. 1886.

JOHNS HOPKIN'S UNIVERSITY CIRCULARS. Baltimore, 1886.

ANNUAL ANNOUNCEMENT of the New York College of Veterinary Surgeons, and School of Comparative Medicine. Session 1886-7.

CATALOGUE AND ANNOUNCEMENT University of Pennsylvania, 1885-86. Department of Biology, and Auxiliary Department of Medicine.

CATALOGUE Meharry Medical Department of Tennessee College, 11th Annual Announcement. Nashville, 1885-86.

CORNELL UNIVERSITY REGISTER, 1885-86. Ithaca.

ON THE LIMITATION OF THE CONTAGIOUS STATE OF SYPHILIS, ESPECIALLY, IN ITS RELATION TO MARRIAGE, G. F. N. Otis, M. D. New York: Wm. Wood & Co., 1886.

FIRST ANNUAL REPORT of the Bureau of Animal Industry, for the year 1884, Washington, 1886.

THIRD ANNUAL ANNOUNCEMENT of the School of Pharmacy, Purdue University, 1886-87. Lafayette, 1886.

PURDUE UNIVERSITY, School of Pharmacy, Bulletin No. 1.

BULLETIN of the Brookville Society of Natural History, No. 2. Richmond, Ind., 1886.

A MANUAL of the Diseases of the Elephant and of his Management and Uses, by John Henry Steel, A.D.V., M.R.C.V.S., Co-editor of the Quarterly Journal of Veterinary Science in India: illustrated. Madras, 1885. Review in October number of Journal.

ANNOUNCEMENT of the New York Society for the Prevention of Contagious Diseases. June, 1886.

HATTER'S CONSUMPTION, by J. W. Stickler, M.S., M.D. Reprint from the New York Medical Journal.

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ORIGINAL COMMUNICATIONS.

Art. XVI.—AVIAN TUBERCULOSIS. AN ILLUSTRATION OF AMŒBIC WARFARE.

BY JOHN BLAND SUTTON, F. R. C. S.

Sir Erasmus Wilson Lecturer on Pathology, Royal College of Surgeons, England. Assistant Surgeon and Demonstrator of Anatomy, Middlesex Hospital, London.

It is a fact well recognized that the inhabitants of certain regions of the earth suffer from diseases which are rare or even unknown in other parts, some affections are known to be endemic within even a limited area, whilst others are more or less peculiar to certain races of mankind independent of locality. Thus disease has an ethnological as well as a geographical distribution.

There is in addition a *zoological* distribution of disease, that is to say, every great group of animals suffers to a larger extent from some affections than others, these may not inaptly be termed the "scourges" of the group. Further if a disease is a scourge to two groups of animals, the lesions in both cases differ in their manifestations in important particulars. This may be partly due to structural peculiarities as well as to differences in the environment, whilst the specific irritant remains the same. The term "irritant" is employed to indicate any substance capable of initiating the inflammatory process. As we shall see later, the scourges are the result of the influence of *specific* irritants which have a predilection for certain groups of animals and, in some cases, for particular orders of a group.

There is also little doubt that the majority, if not all these scourges are due to the presence of living matter, either animal or vegetable, which thrives on the tissues of living forms. This is merely an extension of parasitism for as we know *Tænia echinococcus* is common to wolves and dogs, *T. medio cannellata* to sheep and oxen, *Cœnurus cerebralis* flourishes in the brain of sheep, and some species of *Acari* are only found on the ears of bats; these are merely familiar instances out of a long list that could be adduced.

To return to the affections or scourges with which we are most concerned in this article, it may be stated that syphilis, typhoid fever, and tuberculosis, (including in this latter term phthisis) are scourges of the human race. The first has never been found except in man. The second, typhoid fever* has been described in monkeys, and a few animals other than man. Tuberculosis though widely distributed, nevertheless devastates the human almost as extensively as any other species. Among the Equidæ glanders and anthrax are notorious affections, whilst asses are infested to an alarming extent by the worm *Strongylus armatus.* Walley speaks of Eczema epizootica, Perlsucht, Pleuro-pneumonia and Rinderpest as the four *bovine* scourges.

In this article it is proposed to give an account of a remarkable, widespread and fatal disease, affecting more particularly grain-eating birds, now becoming familiar as *Avian Tuberculosis.* The affection may be described as the scourge of this section of the feathered tribe.

HISTORY.

Although several writers have described at different times isolated cases of tuberculosis in the fowl, it was impossible from the peculiarity of the lesions to decide whether the disease was a genuine tuberculosis. Indeed it was not until the discovery by Koch of the tubercle-bacillus that pathologists had any definite criterion whereby the determination could be effected. So variously were the lesions in the case of birds interpreted, that as will be illustrated further on, some writers considered the lesions as scrofulous, others as gout, and in some instances they were reported as sarcomata.

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*Path. Soc. Trans. vol. xxxvi, p. 527, and this Journal v. vii, p. 218.

My first researches into the nature of this disease commenced in the spring of 1879. A farmer having lost a large number of fowls in a very short time, requested me to investigate the cause of death, at the same time gave me permission to use the remaining birds in any manner likely to facilitate the inquiry. Taking full advantage of this opportunity I was enabled to make myself fully acquainted with the leading features of this interesting disease. In 1881 a second outbreak occurred which affected chiefly the young birds. In this as in the preceding epidemic only grain-eating birds were affected, ducks and geese escaped entirely. In the meantime fowls, from other poultry yards had been furnished me, and it soon became evident that the disease was widely spread in England, for specimens of the affection were received from Leeds and Middlesborough in Yorkshire, from Kent, very many places in Middlesex, and from Didcot and Hagbourne in Berkshire. The occurrence of tuberculosis in these places may be regarded as showing that it is probably met with in most parts of England.

In 1881 I began to attend systematically at the Zoological Gardens, London, and soon found the disease to be excessively common. For two years observations were made to determine the anatomical and zoological distribution of the disease, as determined by the analysis of the causes of death in one thousand birds of various species. In the meantime Dr. Heneage Gibbes had joined me in the work for the purpose of determining the relation of the bacilli to the lesions. In the following November (1883) we made a joint communication to the Pathological Society of London dealing briefly with the matter. Since that date many remarkable cases have come under observation which will enable a fairly complete monograph of this affection to be written.

During the early part of the investigation the view that the lesions were tubercular rested merely on analogy, but Koch's discovery of the tubercle-bacillus, in 1882, furnished an admirable means of judging as to the true nature of the nodular masses. It was for the purpose of establishing or disproving the tubercular nature of the disease that Dr. Heneage Gibbes in the summer of 1883 kindly took part in the investigation. The result was that myriads of bacilli were detected in the diseased tissues.

Before the results of our labors could be communicated to the Pathological Society, Ribbert of Bonn published a paper in the *Deutsche Med. Woch.* 1883, p. 413 and announced the parasitic characters of the disease and the identity of the bacillus with that described by Koch from diseased tissues in human tuberculosis. Since this date an admirable article has appeared in the *Journal de L'Anatomie et de la Physiologie*, Tom. xxi, 1885, written by V. Cornil et P. Mégnin, entitled "Mémoire sur la Tuberculose et la Diphthérie chez les Gallinacés," containing an account of the microscopical characters of the lesions, as well as confirming the presence of the bacilli. To all these investigators reference will be made in discussing the pathology of the disease, as well as to the inquiries of Nocard relative to the production of this disease, by feeding fowls with sputa derived from tuberculous patients.

Due credit must be given to Dr. O. Larcher, who, in 1871, published a short notice in the *Recueil Veterinaire*, headed "*Note pour servir a l'histoire de la tuberculisation du foie chez les oiseaux.*"

Dr. Edwards Crisp has recorded in the Transactions of the Pathological Society, London, several instances of tuberculosis in birds. A few isolated cases have been noted from time to time in various journals, but no systematic investigation, carried out on an extensive scale, has been attempted except my own endeavours. Again, it is necessary to emphasize the fact that we have no proof that these occasional cases reported as tubercle were genuine examples, for the disease is closely simulated by certain other affections, quite distinct in nature from tuberculosis, and it was not until the discovery of the bacillus, by Koch, that we had any criterion whereby differentiation could be effected with certainty. It is interesting that the identity of the bacillus, in avian and in human tuberculosis, should have been established at the same date quite independently by Dr. Gibbes and myself, in London, and by Dr. Ribbert at Bonn, although Ribbert's paper has certainly priority of publication.

As a matter of convenience a list of the chief writings relating to this disease is given here:—

1. **Larcher**, Dr. O.—Note pour servir a l'histoire de la tuberculisation du foie chez les oiseaux.—*Recueil Veterinaire*, 1871.
2. **Crisp**, Dr. **Edwards**.—Some cases of tubercle in Birds scattered in the Transactions of the Pathological Society of London.
3. **Ribbert**, Dr.—Ueber de Verbreitungsweise der Tuberkel bacillen bei den Hühnern.—*Deutsche Med. Wochenschrift*, July 11, 1883.
4. **Sutton**, J. **Bland and Gibbes**, Dr. **Heneage**.—Tuberculosis in Birds. Read before the Path. Society of London, Nov. 1883. Published in *Path. Transactions*, vol. xxxv, 1884.
5. **Koch**, Dr. R.—Die Aetiologie der Tuberkulose. *Mittheilungen aus dem Kaiserlichen Gesundheitsamte.* Herausgegeben von Dr. Struck. Zweiter Band, 1884, S. 1.
   This paper contains a brief account of tuberculosis in hens (Tuberkulose des Huhnes) at page 41 of the report.
6. **Cornil**, V. and **Megnin**, P.—Memoire sur la Tuberculose et la Diphtérie chez les Gallinaces.—*Journal de l'Anatomie et de la Physiology.* Tom. xxi, 1885, p. 268.
7. **Larcher**, Dr. O.—Etude sur la goutte des Oiseaux comparée a celle de l'Homme.
   A paper read before la Societé Central de Médecine Veterinaire, Jan., 1884.
8. **Klein**, Dr.—*Micro*-organisms in health and disease, a series of articles published in the *Practitioner*, in 1884. Since republished in a collected form.
   On page 101 of the first edition, the bacilli of a tubercular rhea are figured and described, taken from one of Dr. Heneage Gibbes' specimens.
9. **Nocard**.—Sur une Tuberculose zoogléique des oiseaux de bassecour.—*Recueil de Médecine Veterinaire*, May 30, 1885.
10. **Nocard**.—A paper on Tuberculosis in Birds, an abstract was published in the British Med. Journal, for July 10, 1886, taken from a paper read before the Central Veterinary Society of Paris.

Besides these paper, some important researches on infective diseases of birds possessing great interest in regard to the ætiology of these diseases are contained in the writings referred to below.

11. TRASBOT, LEOPOLD.—Expériences sur la transmissibilité de la Diphthérie des Volailles aux autres espéces animales. *Comptes Rendus de la Société de Biologie.* Series vii, Tom. 1, 1879.

12. MEGNIN.—Sur la Diphthérie des oiseaux et sa prétendue analogie avec celle de l'homme. *Comptes Rendus de la Société de Biologie.* Series vii, Tom. 1, 1879.

M. M. TRIPIER ET ARLOING—PIETRO PIANO.—Cornil and Megnin give an account with references to some independent researches of these writers on the subject of Diphtheria in birds and its relation to a gregarine. Consult the sixth reference in preceding list.

LŒFFLER.—Untersuchungen über die Bedeutung der Mikro-organismen für die Entstehung der Diphtherie beim Menschen, bei der Taube und beim Kalbe. Struck, *Mittheilungen.* Zweiter Band, 1884.

WOLFF, MAX.—Eine weitverbreitete thierische Mycose.—*Virchow's Archiv.* Band 92, S. 252.

ZOOLOGICAL DISTRIBUTION OF THE DISEASE.

Zoological distribution of disease has received little attention at the hands of pathologists, yet many facts of great interest would be added to our stock of knowledge if this subject were systematically investigated. An inquiry into the distribution of tuberculosis among the various classes of the feathered tribe has been of signal service in enabling me to narrow the issue as to the probable origin of the disease. A somewhat detailed account may not be without interest to the reader.

In my early investigations note was made of the birds which suffered most from the disease, and it has been already mentioned, that so far as the farm-yard epidemics were concerned, that grain-eating birds were alone affected. Since I have been in regular attendance at the gardens of the Zoological Society, the average monthly mortality has been about one hundred, giving a yearly average for the past five years of one thousand, two hundred. Of this total nearly one-half (five hundred) were birds, and the list embraces most of those known to the ornithologist. From this source alone, a very good notion regarding the zoological distribution of the disease could be derived. Even after one year of work, it became evident that the disease was almost peculiar to graminiverous, and fruit-eating birds and vegetable feeders. The affection occasionally occurs in birds of prey, and its presence in them is capable of another explanation.

Birds which live on fish appear to be totally exempt from tuberculosis, and this is also true of water-fowl. Among struthionidæ, the rhea, (South American ostrich) is especially liable to the disease, indeed, among thirteen specimens of this bird which have died since 1881, twelve were thus affected, the remaining rhea was found dead one morning with a wound in the back of its head. It had only been an inmate of the gardens a few days, and was free from all traces of tubercular lesions.

The Emu *Dromæus novæ-hollandiæ* is subject to the affection *especially when born in the gardens.* The facts concerning these birds will be fully discussed in the section devoted to Pathology.

Of other species of birds, the common fowl, peacock, Guinea fowl, tragopan, grouse, pigeon and partridge are especially liable to tuberculosis. Storks and cranes are not exempt from it.

Opportunities have also occurred for studying the disease in parrots, and some facts of no small degree of importance have been brought to light by a careful examination of the circumstances in the outbreak of the disease in these birds.

With regard to the cases which have occurred in flesh-eating birds, a few remarks must now be offered. In the early account of avian tuberculosis, published in 1883, the only rapacious birds in which this affection had been detected with certainty were a falcon and an eagle, and it was added, "possibly they contracted the disease by feeding on smaller birds affected with tuberculosis." Since that date two other instances have occurred in flesh-eaters, an owl and the secretary bird. Diseases which simulate tuberculosis, especially so far as the liver is concerned, are often found in birds of prey, so that it is necessary to be careful in verifying the diagnosis by using the microscope. In the case of the secretary bird the characteristic nodules were observed in the mouth and on the tongue several weeks before it died.

The following observation made by J. F. Larcher shows that the disease may occur in wild birds, for he informs us in the note before referred to that a sparrow hawk which was taken in a snare at the moment when it pounced upon some gold finches, presented tubercular nodules in the liver, in the lungs and other parts of the body. Gold finches and other finches are frequently sufferers from this affection, and the hawk may have contracted the tubercles as a result of previous depredations among these pretty birds.

It is of utmost importance to adduce all the evidence that can be possibly pressed into the service, to strengthen the view that flesh-eaters get their tuberculosis by devouring infected grain-feeders, that the following case will be briefly quoted:

In February, 1883, I exhibited the liver of a Python, *Python sebæ* which presented curious nodules in the liver. The details of the case are reported in vol. xxxiv of the Path. Society's Transactions, and described as pyæmic abscesses, secondary to a large abscess in the wall of the abdomen, for it was difficult to account for them at that time in any other way that was satisfactory. As soon as bacilli were found in the nodules of the fowls, I at once submitted portions of the liver of the snake, which is preserved in the Museum of the Royal College of Surgeons to Dr. Heneage Gibbes to determine whether the bacilli which had been noticed in the lesions of the liver, were identical with those in the nodules of the bird's liver.

Examined under the improved knowledge derived from a study of the affection in birds, the case came out in a totally new light, for not only were the bacilli unmistakable tubercle-bacilli, but the microscopical details of the nodules in the snake's liver harmonized in every way with those characteristic of avian tuberculosis. Previous to this re-examination of the specimen by Dr. H. Gibbes and myself, Mr. F. Eve, the Curator of the Pathological Department of the Museum had rejected the pyæmic view of the lesions, and had deposited the specimen in the Museum as an example of tuberculosis. This independent testimony is very valuable.

This snake was fed on fowls, pigeons and ducks, as a rule, and there is, so far as I can see, only one way out of the difficulty. The source of mischief was undoubtedly derived from the alimentary canal; the birds, pigeons and fowls are excep-

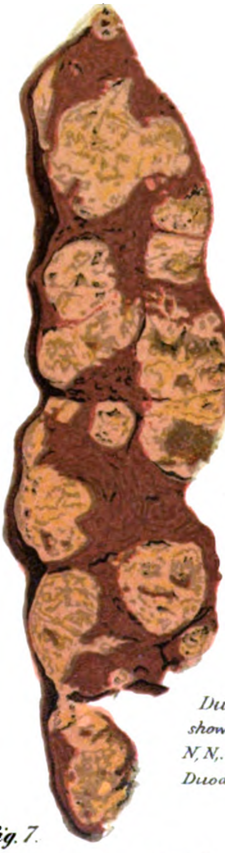

Fig. 7.
Spleen of a rhea affected with tuberculosis.

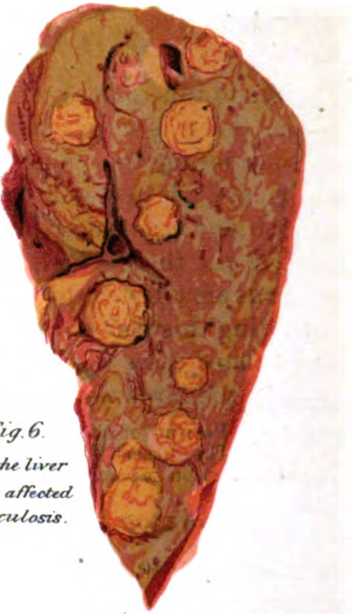

Fig. 6.
Section of the liver of a Pheasant affected with tuberculosis.

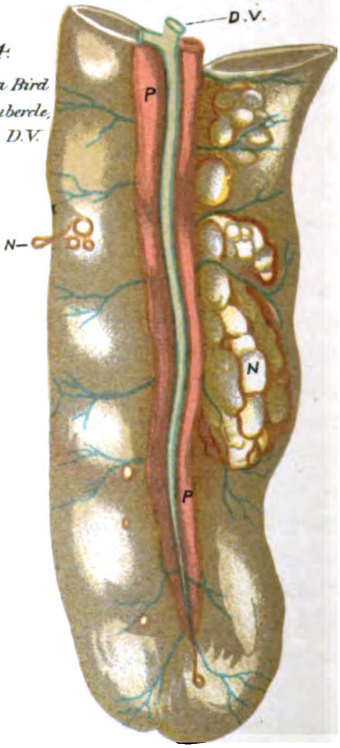

Fig. 4.
Duodenal loop of a Bird showing nodules of tubercle, N, N,. P the pancreas. D.V. Duodenal Vein.

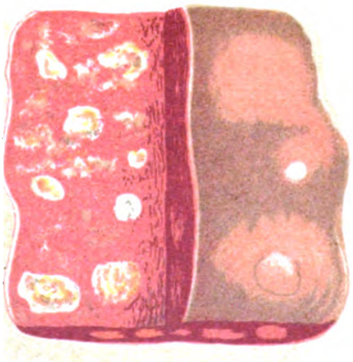

Fig. 1. Portion of Liver of a Python Python Sebæ, affected with tuberculosis.

Lith. D. Appleton & Co N. Y

tionally liable to tuberculosis, and there can be but little doubt that this was the true source of infection.

When considering the enormous number of grain-eating birds which are affected, and the very few instances of the disease in fish and flesh-eaters, and bearing in mind the disease is an infective one, there remains little doubt on my mind that rapacious birds are affected through devouring tubercular prey.

In concluding this part it may be emphatically stated that, in the few isolated cases which have been recorded in periodical literature, the birds were graminiverous.

Fig. 1, Plate II.—Portion of the liver of a Python (*Python Sebæ*) affected with tubercle. The disease was probably contracted in consequence of the snake being fed on tubercular birds.

ANATOMY OF THE ALIMENTARY CANAL.

Before entering into the details of the distribution of the lesions characteristic of avian tuberculosis, it is essential, for a clear understanding of the question, to consider the main features in the anatomy of the alimentary canal and especially in relation to the distribution and destination of the veins. It is unnecessary to discuss the various forms assumed by the digestive canal in birds, but to choose some type easily obtainable and of such a size that the individual parts may be demonstrated in a simple manner. The common fowl fulfills all the required conditions.

In the accompanying drawing (Fig. 2), *O* represents the œsophagus, presenting on the anterior aspect, near its middle, a globular swelling known as the crop, *C.* The œsophagus terminates in that singular muscular mill, the gizzard, *G;* from this organ the efferent canal is the duodenum, embracing the pancreas. The remarkable U-shaped arrangement of this part of the gut is peculiarly avian. Near the termination of the ascending or distal loop the bile and pancreatic ducts enter the wall of the bowel. To this succeeds the small intestines suspended, as usual, by a mesentery. Approaching the cloaca, two cæca (*Ca*) suddenly stand off at an acute angle. The point at which they join the gut marks the commencement of the large bowel; this, after a short course, terminates in the cloaca or common chamber for the genito-urinary products, *C.*

The most noteworthy features in the various sections of the alimentary tract, which have any bearing on the subject matter of this article, may be briefly mentioned. The proventriculus, or crop, possesses in its walls a series of glands, the secretion from which serves to moisten and soften the grain. The gizzard normally contains small stones, which are set in motion by the contraction of the walls and thus serve to triturate the grain. In many birds the mucous lining of the bowels has a soft, velvety appearance, due to the presence of innumerable villous processes. In no bird has the author yet succeeded in detecting Peyer's patches, although in a young Emu chick small rounded patches, not unlike the solitary follicles, were visible. The cæca vary in length within very wide limits. In the fowl they are six inches in length, yet in the pigeon they merely appear as a pair of minute diverticula from the wall of the bowel. The mesentery contains a plexus of lymphatic vessels of considerable size, but the mesenteric glands, so conspicuous in the majority of mammals, seem to be entirely absent in the bird. This is of some importance, for ignorance on this point has led one or two writers on avian diseases into a few misconceptions.

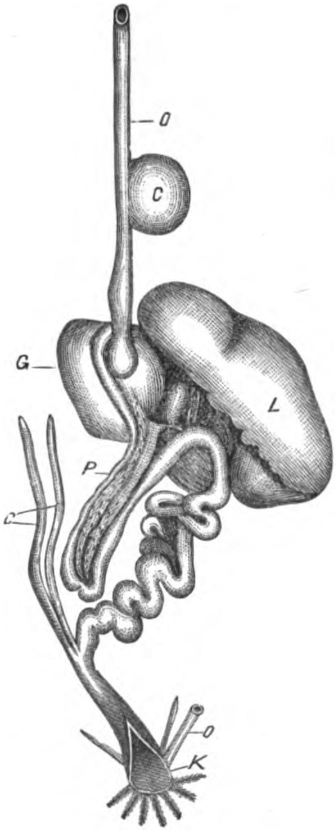

FIG. 2.—Alimentary canal of a fowl. *O*, œsophagus. *C*, the crop. *G*, the gizzard. *L*, liver. *Ca*, the cæca. *K*, the cloaca. *O*, the oviduct; and *P*, the pancreas.

We must now consider the disposition of the abdominal venous system. In birds a very free anastomosis exists between the portal and systemic veins; the venous circulation is further complicated by the existence, though slightly developed, of a renal-portal circulation. The arrangement of the veins may be gathered from a glance at the diagram, Fig. 3. The blood returns from the extreme hinder end of the body by the caudal vein, *C V*, which on reaching the first caudal vertebra divides into three main trunks, the lateral branch of each side is in the chick, reinforced by the hypogastric vein, and passes on to the kidney and distributes branches to that organ, which break up into a capillary venous network to join the radicles of the renal vein, thus constituting a rudimentary renal-portal system. The main stem of this vein joins the renal and is at this spot reinforced by the efferent vessel of the hind limb, the crural or sciatic vein. A common trunk thus arises which meets with the fellow of the opposite side to form the inferior vena cava. This receives various tributaries, but chief among them is the hepatic vein; it then opens into the right auricle of the heart.

Returning to the caudal vein we shall find that the median of the three trunks, into which it is divided, is of good size, and continues its course through the mesentery about half an inch from the border of the bowel. It forms not only an anastomosis between the portal and systemic veins, but may be regarded as the origin of the portal system itself. The vein follows closely the attached border of the gut and receives near the spot where it enters the liver, two tributary trunks of importance in connection with the distribution of the lesions. The two veins are the duodenal *D*, and the splenic *S*.

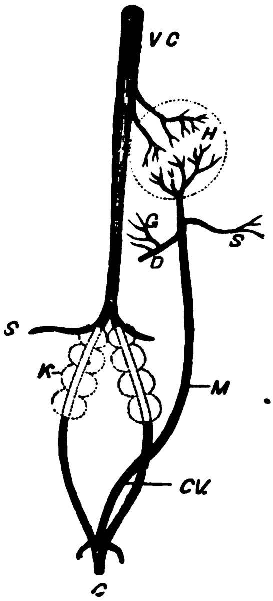

Fig. 3.—A diagram to represent the relations of the portal and systemic circulations in birds. *C*, caudal vein, giving off *C V*, a connecting branch between the systemic and portal veins. *D*, duodenal vein, receiving branches from the gizzard. *S*, Splenic. *M*, mesenteric vein. *k*, the kidney. *H*, the liver. *V C*, vena cava inferior. *S*, sciatic vein.

In mammals the portal trunk is usually the result of the confluence of the splenic and superior mesenteric veins. In birds, however, it may be regarded as being formed by the union of the duodenal and superior mesenteric veins, the splenic vein joining the trunk immediately above the union.

The splenic vein is of small size and commences in a few twigs on the walls of the proventriculus, these form a single vessel which runs along the hilum of the spleen.

The duodenal vein is formed by small branches arising on the wall of the loop, these converge so as to give rise to a median vein lying close to the pancreas, from which it also receives tributaries as well as numerous branches from the muscular walls of the gizzard.

The point of especial interest in this arrangement is, that if the portal circulation became hindered, congestion of the spleen would be a necessary consequence.

MORBID ANATOMY.

The lesions peculiar to this disease differ in a remarkable manner from all known forms of tuberculosis, in that the alimentary canal and associated viscera are the parts almost exclusively affected.

In the first place the appearances found in typical cases will be described, then the chief variations and anomalies will be considered.

Birds which have succumbed to this disease are always extremely emaciated. On opening the abdomen a small quantity of fluid invariably escapes, for ascites is a prominent symptom in the later stages. The intestines are often matted together by adhesions and flakes of lymph are usually to be found. The most striking feature, however, is the existence of hard, irregular, craggy-looking masses, of a yellowish-white color, which project from beneath the serous coat of the small intestine. As a rule they are most abundant in the neighborhood of the duodenum and the segment of gut next succeeding. In severe cases the whole length of the alimentary canal, including the cæca, are studded with these nodules, which vary from a mass the size of a walnut to microscopic dimensions. The larger deposits are sessile, but it is by no means unusual to find small pedunculated masses of the size of a pin's head swinging from the exterior of the gut.

For a general notion of these refer to the duodenum shown in Fig. 4, Plate II. On cutting into the nodules they will be found to present a spurious capsule, but the interior is composed of pale-yellow material, exactly resembling that seen in a caseous abscess. On slitting up the gut it will be found that the condition of the peritoneal aspect is no guide to the state of the mucous membrane, for the interior will be found thickly studded with nodules in cases where only one or more of the masses can be detected externally. This is admirably illustrated in the case of the Emu whose intestine is represented in Fig. 5. The mucous surface is richly dotted with nodules but not one gave evidence of its presence externally. The nodules on the outer wall of the gut are of a pale color, and during life were covered with a rich plexus of capillaries, but those of the mucous surface are inky black in color, this is no doubt to be attributed to the action of sulphuretted hydrogen.

Fig. 4, Plate II.—The duodenal loop and pancreas of a fowl showing nodular tubercular masses.

The lymphatic vessels leading from the gut to the mesentery are often engorged with the same material which forms the centre of the nodules, and at times rupture and lead to extravasation of the caseous material between the layers of the mesentery; this has deceived some investigators—they describe such irregular masses as lymphatic glands, whereas these are absent in the bird's mesentery.

As might be expected the presence of these abnormal masses when of fair size cause intestinal obstruction, and a remarkable instance is represented in *Fig.* 5. It is the gut with the paired cæca of a rhea which died suddenly. On opening the abdomen, the peritoneal chamber lodging the intestines, was occupied by a large quantity of clotted blood. On removing the viscera the hæmorrhage was found to arise from some ruptured arterioles due to congestion as the result of an intussusception. The invagination commenced in the small bowel *S B*, in consequence of an annular tubercular mass deposited in its mucous coat *N'*, the lumen of the obstructed gut is indicated by the arrow. The shortening of the meso-cæcum *M*, as a result of the intussusception has allowed the cæcum *C'* to become also invaginated, assisted no doubt by the nodules *N''*. The length of the specimen is twenty-four inches. Smaller degrees of intussusception are very common. The cæca of the rhea presents an arrangement of its mucous membrane somewhat resembling the spiral valve found in Elasmobranch fishes.

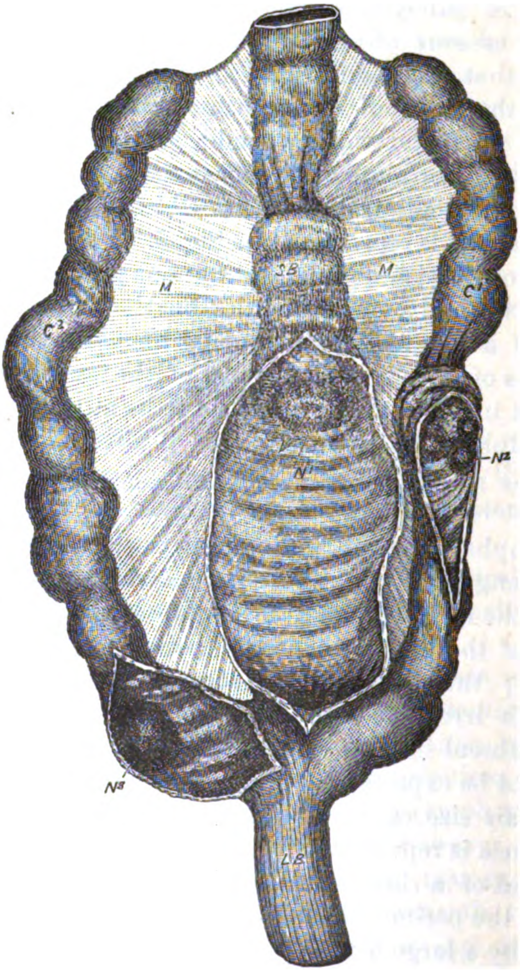

Fig. 5.—Portion of the small and large intestine with the cæca of a rhea, ***Rhea Americana.*** The tubercular nodules have brought about intussusception of the small gut and led to shortening of the meso-cæcum so as to allow an invagination to occur in the right cæcum.

Fig. 6, Plate II.—Section of liver of a Pheasant affected with tuberculosis. From a photograph by Dr. H. Gibbes.

Fig. 7, Plate II.—Section of the spleen of a Rhea affected with tuberculosis. From a photograph by Dr. H. Gibbes.

The Liver.—This gland presents remarkable changes; in severe cases it is enlarged and studded with rounded masses which may vary in size from a millet seed to that of a nut. When recent they are of yellowish-white color and often possess a very beautiful network of pink capillaries. On section they present the same caseous appearance as in the intestines. In the early stages it is impossible to accurately distinguish these deposits from those due to parasites such as gregarinidæ and the like, without searching for the bacilli. A typical example of a tubercular liver taken from a pheasant is shown in Fig. 6, Plate II, the nodules occur not only beneath the capsule of the liver, but throughout its parenchyma.

The *spleen* rarely if ever escapes, the deposits resemble in every respect those met with in the liver and intestines. A severe example of the disease affecting the spleen is shown in Fig. 7, Plate II, taken from a rhea, *Rhea Americana*. In some cases the spleen is so crammed with the morbid material that the capsule ruptures.

The lungs are not often affected and when the nodules are present in these organs they rarely exceed in size a split pea.

The larynx I have seen affected twice only, in a secretary bird and a hornbill.

Lymphatic System.—It has already been mentioned that the lymphatic vessels of the mesentery become engorged with caseous material. In severe cases, the lymphatics may become generally affected and the morbid material dispersed throughout the body—the eyelids, wings, thighs and subcutaneous tissues. Two lymphatic glands, situated in many birds at the root of the neck, may occasionally become infected and may attain a very large size.

A careful comparison and analysis of many cases of tuberculosis in birds, made at all stages of the disease, enables me to offer a satisfactory explanation of various apparant anomalies in the distribution of the lesions.

In the first place, it will be assumed that the morbid material gains entrance, in the majority of cases, by way of the intestines. In every case examined by me, in which the disease originated in this way, the duodenum has always been affected and has been found diseased when no other deposits were visible. The duodenal vein is of large size (Fig. 3, page 339), opens into the portal vein and goes at once to the liver, which is the second viscus in order of infection. The disease extends along the gut; meanwhile, the deposits in the liver, increasing in number and dimensions, necessarily hinder the portal circulation and retard the flow of blood from the spleen. This damming back of the splenic blood allows the infective bacilli to find an easy road to the spleen, and this organ is the third in order of infection.

The majority of cases never pass beyond this stage; occasionally, however, the bird survives longer, and the gut becomes further involved, until the region of the bowel drained by the vein marked *C V*, in Fig. 3, is infected. As soon as this occurs, the morbid material from the large bowel takes a reverse course and passes to the kidney, infects them, then flows to the inferior vena cava, enters the heart, and becomes disseminated everywhere. So long as the upper segment of the gut alone is affected the capillaries of the liver act as efficient strainers, and arrest the wandering invaders; but as soon as the lower segment is reached, and the infected blood passes by way of the systemic veins, universal distribution is the result.

But this, though by far the most common, is certainly not the only means by which the disease is acquired by birds. In discussing the question of the probable origin of the affection, some remarkable examples of inoculation, by way of the feet, will be considered.

Microscopical Details.—The histology of the tissues affected in this disease demand consideration under three headings. (1) The structure of the nodules. (2) The characters of the bacilli and their relation to the lesions. (3) The blood vessels and the share they take in distributing the bacilli.

(1). *The Structure of the Nodules.*—It is preferable to choose portions of diseased tissue from the liver for purposes of examination, and to classify the nodules into two groups, recent and old, for they differ materially in structure and relation to bacilli according to their age.

In the youngest nodules the centre is made up of small round, and giant cells, whilst the periphery is made of fibroid material, such as is usual in the immediate neighborhood of inflammatory foci. The bacilli are clustered together in the centre of the mass, and many of them occupy the interior of the cells; sometimes as many as three or four bacilli may be counted in a single cell. In the giant cells as many as sixty have been counted. Cornil and Megnin describe a specimen of the bacilli, taken from the liver of a pheasant, as being arranged in the form of a crown. In some cases the bacilli are seen crowded in little heaps, and, in others, arranged in tubular masses as though occupying the lumen of a vessel.

In nodules slightly older the centre is occupied by a more or less caseous mass, quite free from bacilli, these little bodies occupying a zone outside the degenerating area.

In successful sections of the largest nodules four zones may be distinguished. The centre is occupied by a caseous material; this is bounded by a ring of cells, resembling those found in human tuberculosis, and termed "epithelioid;" to this succeeds a layer which may be named, with Ribbert, "the bacilliferous zone," and, lastly, we have a zone of inflammatory tissue. In the bacilliferous zones giant cells may be found of very large size, and frequently four or five may be counted in a single section.

There is substantial agreement on all points connected with the histology of the nodules in the account given by Ribbert, Cornil and Megnin, Heneage Gibbes and myself. The relation of the bacilli to the cells are shown in Fig. 8. Cornil and Megnin have given some drawings from which a very good notion may be formed of the enormous number of bacilli which crowd the sections, especially those made from the liver. The bacilli may be stained by any of the ordinary re-agents used for detecting them in human sputum.

(2). *The Bacilli.*—All who have inquired into the subject of avian tuberculosis in reference to the bacillus have come to the conclusion that it is identical with Koch's tubercle-bacilus, not only in its morphological characters, but also in its re-action to staining reagents, Dr. Gibbes * reports as follows:—"They have the same re-action to staining agents as the bacilli of tuberculosis, with a high magnifying power (x 4000) they are indistinguishable from them, and they also contain rounded bodies resembling spores." Cornil and Megnin draw attention to the fact that some of the cells present granules in their interior, which take the same stain as the bacilli. They also mention that the bacilli contain granules in their interior, visible under high magnifying power, and add: "The large cells bristling with tufts of bacilli usually possess a single nucleus, they resemble leprosy cells, but contain more bacilli than is usual in the large cells of leprosy nodules." Dr. Klein † who had an opportunity of examining some of the sections from the liver of the rhea, regarded the disease as leprosy; this is obviously a mistake, the two affections having little in common, but a resemblance of bacilli.

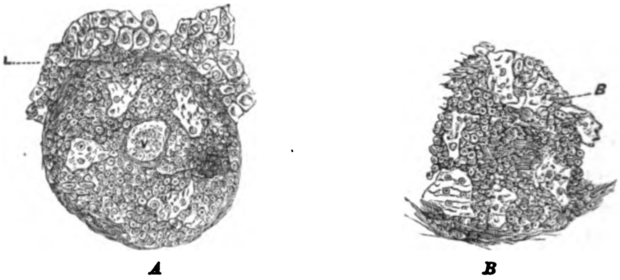

Fig. 8.—*A*, a section of an early tubercular nodule from the liver of a pheasant with caseating centre. *B*, section of a nodule in a later stage, to show the caseous center and the marginal bacilliferous zone.

(3). *The blood vessels considered in relation to the distribution of the bacilli.*—From an anatomical standpoint alone it is evident, as I have endeavored to show, that the bacilli are distributed by means of the blood vessels. Whilst detailing the microscopic appearances of the nodules, attention was drawn to the fact that the bacilli are in places crowded in little heaps, and in places arranged in tubular masses as though occupying the lumen of a vessel.

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* Path. Trans. vol. xxxv.

† Micro-organisms and disease. A series of articles in the *Practioner*, 1884.

Cornil and Megnin note that in some of the section the bacilli lie crowded in fissures, some of which represent vessels cut longitudinally. In one of the drawings taken from the liver of a pheasant a vessel is shown in tranverse section, the lumen of which contains a cluster of these little rods.

If any one takes the trouble to examine the liver in the earliest stage of tuberculosis, or endeavor to select recent nodules in an infected liver, he will be able to satisfy himself that in the majority of cases the nodule is in close association with a vessel, and in very many cases the lumen of the vessel forms a central spot from which the bacilli radiate as from a focus.

The best research on this head is that of Ribbert, who studied this part of the matter in the pulmonary vessels, for he found the parallel bundles of connective tissue forming the walls of the veins thickly invaded by the bacilli which were grouped together in irregular masses. In places they encroached upon the lining membrane of the vessel and caused bulgings resembling minute tubercles and similar relations could be made out on the arteries.

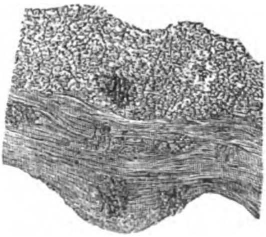

Fig. 9.—Section of a vein from the lung, the walls of which are crowded with tubercle-bacilli.

(4). *The relations of the blood to the bacilli.*—Within the last few years the attention of biologists has been attracted to the phenomenon known as intra-cellular digestion. Chief among investigators in this particular direction is the eminent Russian naturalist, Metschnikoff, who has published accounts of most interesting combats he has witnessed in invertebrate forms between bacilli and leucocytes. These researches have gone a very long way towards modifying our views of the nature of the inflammatory process. In my lectures delivered at the Royal College of Surgeons, London, in the capacity of Erasmus Wilson Lecturer, and since published in a collected form,* a review of the chief facts connected with this important phenomenon is given in its bearing on the pathology of inflammation. It is not proposed to spend time in discussing the evidence in this paper, but I shall be content with observing that there are grounds enough for believing that when bacilli, bacteria, micrococci and other micro-organisms enter animal bodies, the leucocytes, (if the organism is sufficiently complex to possess such bodies,) engage them in combat and attempt their destruction by ingesting and digesting them, and so rid the body of substances calculated to do it harm.

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* An Introduction to General Pathology, 1886.

My studies on avian tuberculosis have convinced me more thoroughly of the defending power exercised by leucocytes than any observations I have yet been able to make on an animal so higbly organized and specialized as a bird.

There can be no doubt that the bacilli in this affection from whatever source arising, are introduced with the food into the alimentary canal, and thence find their way into the walls of the bowels.

That the bacilli gain entrance to, and are disseminated by the blood vessels is beyond all question, as they have been found by those who have investigated the disease occupying the interior as well as the walls of arteries and veins.

On reaching the vessels the bacilli are attacked by the leucocytes, surrounded and taken into the protoplasm entire, where they may become digested and destroyed. One leucocyte may ingest two or more of the enemy.

The leucocytes when laden with spoil need not necessarily remain in the vessel but pass through the vessel-wall into the surrounding tissue. Further from what we now know of "amœbic warfare" in invertebrates, frogs, rabbits, etc., if a detachment of bacilli occupy a capillary or leave the vascular channels, a troop of leucocytes are quickly on the spot and become reinforced by comrades at a rate wholly out of proportion to the ratio normally existing between the red and white cells of the blood. Metschnikoff has shown and I have confirmed his results, that in some cases a leucocyte struggling with a bacillus or a coil of bacilli, may receive help by two or more leucocytes fusing with it to form a larger mass—a giant cell. In the lower animals giant cells occur with much greater frequency than in man, in lesions, which are the result of specific irritation, that is to say, due to the introduction into the system of a virus, such as glanders, actinomycosis, syphilis, and the like. The lesions characteristic of this class of affections belong to an increasing list known as the infective granulomata, whose chief characters consist of the following: They are made up chiefly of round cells with very little intercellular material, in most instances giant cells are present; they are poorly supplied with vessels, hence the central portions, those farthest removed from the blood stream die. Micro-organisms of some kind or another are usually to be detected, and the list of lesions of this class in which they have not yet been found is rapidly becoming reduced to insignificant proportions.

In actual war the victorious, as well as the defeated army, lose numbers of soldiers. In amœbic warfare the bacilli may gain the victory either by force of numbers or by their poisonous effects upon the leucocytes. In tuberculosis the characteristic nodules are to be regarded as battle fields. In the small, recent nodules the struggle was raging at the time the bird died. In the later nodules the central caseous mass is composed of the dead and dying cells, some of which are undergoing disintegration whilst the combat is still going on along the borders. The largest masses mark the spots where the conflict has been long continued. It is in these older masses that the giant cells most frequently occur and as in other cases they arise from the fusion of leucocytes. The giant cells are powerful defenders, for in some nodules taken from the liver of a rhea as many as fifty bacilli could be counted in a single section of one of these singular bodies. In such specimens as these the mass when stained becomes visible to the naked eye, for the bacilli take up the stain so as to give rise to the appearance of a colored dot.

The observed facts in this disease show that it is a struggle between irritant-particles and leucocytes,—in essence, amœbic warfare.

ÆTIOLOGY.

The ætiology of avian tuberculosis is in very many respects one of great importance, for if we arrive at a satisfactory conclusion on this head we may assume with some degree of probability the origin of human tuberculosis also. This section, on these grounds alone deserves the fullest consideration. The zoological distribution of the disease shows it to be almost exclusively confined to grain and vegetable feeding birds, whilst the localization of the lesions convincingly demonstrate that the bacilli are introduced into the system by way of the alimentary canal and thence distributed by the portal and systemic veins.

In the Zoological Society's Gardens, London, the opportunities most favorable for investigation of this question occurred in the pheasants, rheas and emus. The pheasants have for years occupied a particular portion of the gardens, arranged so as to constitute a series of wire enclosures known as the pheasant's aviary. The rheas and emus occupy a series of sheds with adjoining paddocks, and are close neighbors. The ostriches and cassowaries are kept in a part of the menagerie quite distinct from the rheas and emus.

It seemed desirable in the first place to submit the food and water taken by these birds (maize, and monkey-nuts for the pheasants, vegetables and boiled maize for the rheas and emus) to microscopical examination for the purpose of ascertaining the existence of bacilli, but all to no purpose.

That the birds contract the disease in the gardens is beyond doubt. All the rheas which have come under my observation have been imported, some had lived many years in the gardens.

In March, 1884, two young emu chicks were hatched; for a time they did well. In March, 1885, one died and on examining the alimentary canal tiny nodules such as are represented in Fig. 10, were found dotting the mucous membrane.

The nodules contain chiefly round cells of various sizes, here and there giant cells and crowds of bacilli. If they be attentively examined the larger ones present a caseous interior and in many instances the caseous matter has burst the capsule and presented as a black mass looking like a miniature cutaneoüs horn growing from a sebaceous cyst. One of these masses magnified three times is shown in Fig. 10. The liver and spleen presented the characteristic deposits.

Three months after, the companion chick died and an examination of its viscera showed the nodules in a more advanced stage than in the first chick.

For the sake of comparison a piece of gut from this bird is represented by the side of the earlier specimen.

After the caseous matter bursts the capsules it doubtless increases in size from deposit of fæcal matter from the bowel.

These specimens help to show that the disease originates in the mucous coat of the bowel. Recently an emu died which had only lived in the garden seven months, yet its alimentary canal presented nodules such as are seen in *B*, Fig. 10. The specimen is valuable as showing the chronic progress of the disease.

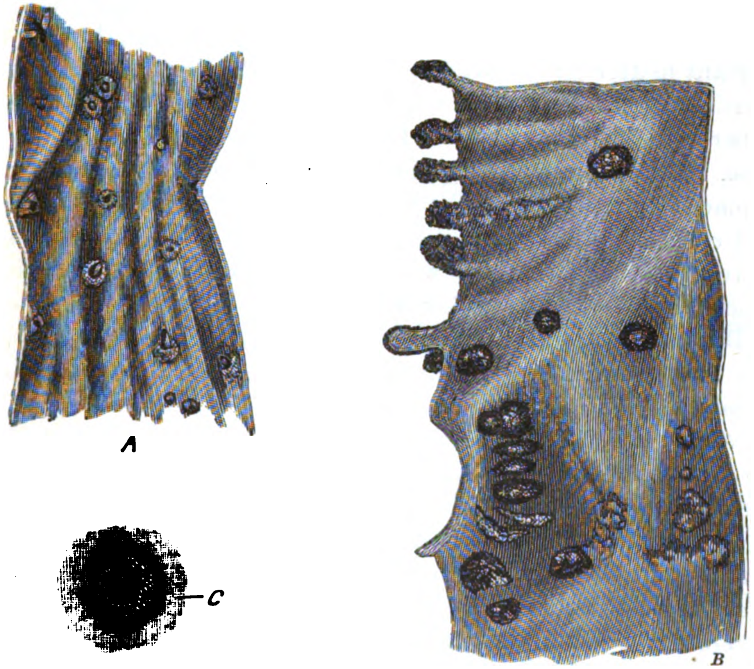

Fig. 10.—*A*, tubercular deposits in the alimentary canal of an emu—early stage. *B*, a later stage. (*C*) one of the nodules from *A*, magnified three times to show the curious horn-like appearance it presents.

The nodules serve as "breeding-grounds" wherein the bacilli may be propagated and the experiments of Cornil and Megnin show that the masses are quite capable of instituting the disease. They injected caseous matter from this source into the peritoneal cavity of a fowl and a guinea-pig. The fowl died some months after with the disease in its liver and intestines, whilst the guinea-pig presented a large caseous abscess at the seat of puncture containing an astonishing number of bacilli.

Although the nodules in the alimentary canal contain thousands of bacilli and in spite of the almost positive evidence that the disease is introduced into the system with the food, yet bacilli have as yet not been detected in the fæces. This, however, does not militate against the bacilli being introduced with the food, for it is not to be supposed that bacilli are always being swallowed; probably one inoculation is sufficient and the micro-organisms once in the body find it a suitable place for indefinite multiplication. There is one other important matter in connection with the fæces, demanding full consideration. The farm which originally supplied me with tubercular chickens and fowls, is now entirely rid of the disease. Following my advice the old stock of birds were entirely replaced by new ones. The hen-houses were cleaned, the old soil replaced by new, and a limited number of birds allowed to roost in each house, the walls and roosts of which are periodically limewhited, and the floors cleaned regularly.

Before these precautions were taken birds died almost daily, but now the disease has entirely disappeared. If we inquire closely into the manner adopted in feeding birds of this class, we shall find that the seed is cast upon the ground to be picked up grain by grain. The birds are constantly dropping their excrement over the same ground, so that the ingesta and egesta are mixed together, in this way the food of to-day is contaminated with fæces which may be many months old. If the birds are confined in paddocks or wire enclosures, the upper layers of the soil must be thoroughly saturated with a mixture of stale food and fæces. It is to this that we must regard as the cultivation material for the bacilli.

Although I made attempts to search for bacilli in these masses of fæces, and have kept birds excreta in variable temperature for long periods, I have as yet failed to detect the bacilli, however, the negative results by no means disproves fæces, and food remains being the growing nidus for these bodies.

The following case seems to me to support the notion of the disease originating in this way very strongly.

Parrots, especially grey ones, have occasionally come to hand with caseous nodules developed upon their feet, resembling in structure those found in the alimentary canal. They also contain colonies of bacilli. In other cases these nodules occur on the wings and trunk, but the viscera remain healthy. The appearance of the feet when affected with tuberculosis may be inferred from Fig. 11. An eminent London physician to whom some of the nodules were shown declared it to be gout.

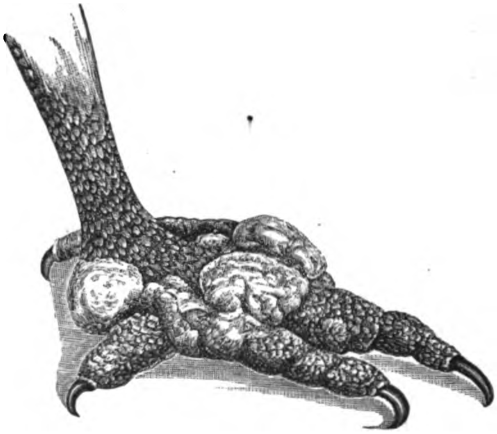

Fig. 11.—Foot of a Grey Parrott affected with tubercular nodules; the deposits have been mistaken for gout.

Dr. O. Larcher published a memoir entitled '*Etude sur la goutte des oiseaux comparée a celle de l'Homme*,* but a perusal of the paper and all the cases he refers to and describes under the heading of generalized gout, visceral gout, and arthritic gout, are examples of the tuberculosis we have been considering. Some of the instances mentioned by Larcher occurred in parrots and parrakeets. My own investigations in this direction have served to convince me that these so-called gouty deposits are tubercular nodules which have had a local origin, and that they have been caused by the birds hopping about in the mixture at the bottom of their cages, which is composed of remnants of food, water and a very large admixture of fæces. These cases strongly support the argument that the true source of the bacilli is in this material.

Grey parrots are very liable to fall victims to an affection the result of micro-coccus invasion, the organisms causing the disease in this instance originating in the fæces and remains of food.

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* Read before la Societé Centrale de Médecine Veterinaire, Jan. 1884.

That the majority of grey parrots brought to England die within six weeks of their importation is a fact notorious in itself, and the reasons have been plainly set forth in a paper by Max Wolff,* headed, *Eine weitverbreitete thierische Mycose.* All the facts stated in Wolff's paper I can confirm from my own experience, as from time to time many of these parrots have come into my hands direct from the dealers in Liverpool, also from various private sources.

Grey parrots are brought to this country from the West Coast of Africa in enormous numbers. The sailors buy the birds and put them in cages one hundred at a time, the cages being scarcely large enough to accommodate twenty-five with any degree of comfort. Crowded in this detestable fashion the birds are put into the hold of the ship where they remain to the end of the journey. From the time the birds leave the African Coast until they are landed the cage is never cleaned; the food is thrown to them, their drink-water rarely changed, and being in a cramped and confined condition some of the birds are trampled to death. Hence the floor of the cage becomes a filthy mass, composed of excrement, remains of food, dirty water, feathers and dead birds.

Of one thousand birds which survive this journey, eight hundred succumb within the first six weeks of landing. Indeed it is rare to find a grey parrot, brought home in this way, survive much longer than two months. The chief appearances found in birds dying in this way, are the following:

The liver contains some two or three score of greyish-white nodules, varying in size from a pin's point to that of a pea or larger. These masses though most numerous, immediately subjacent to the serous membrane are nevertheless scattered throughout the hepatic parenchyma. The spleen and kidneys are similarly affected, the former far more frequently than the latter organ. The lungs present similar lesions in about twenty per cent of the cases examined.

If sections of the nodules be examined after staining with methyl violet, gentian violet, or aniline brown and magnified, heaps of micro-organisms collected in heaps and lying for the most part in the capillaries will be detected. In some cases these micro-organisms so completely block the vessels as to produce thrombosis and ectasia.

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*Virchow's Archiv. Bd. 92 p, 252.

The micrococci, when examined under a Zeiss' oil immersion one-twelfth, ocular 4, are seen as rounded bodies; sometimes they are ovoid in appearance and one-twelfth of a millemetre in diameter; some are twice that size. Suppuration is absent even in the largest nodules. In some of the nodules I have found numbers of giant cells, as many as five or six could be counted in a single section. Micrococci could be detected in some of the plasmodia, (giant-cells.)

The brief narration of facts is sufficient to show that the filthy conditions under which these birds are brought to England explains the source of the micrococci.

Many grey parrots kept as pets on board ship by passengers, properly fed and cared for have lived for many years, and all birds which have been used as pets, examined by me have had no traces of the infective little organisms.

If micrococci of this nature multiply under such conditions and invade animal bodies need we hesitate to believe that the gradual, but constant, accumulation of fæces, food remains, moisture, feathers, &c., in farm-yards or in a crowded hennery should be breeding grounds for bacilli. But what is most significant, is the fact that out of this foul mixture the birds have to pick up their daily quantum of grain, and thus place themselves in the most favorable position possible for inoculation.

The latest contribution to the ætiology of this affection is by Nocard in a memoir read before the Central Veterinary Society, of Paris.* This writer has investigated four epidemics in poultry yards and has come to the conclusion that the birds contracted the disease by coming in contact with persons in the last stage of phthisis. In another epidemic he believed the disease to have been caused by the bird feeding in yards contaminated with the excrement of tuberculous cows. These views are highly improbable.

Nocard, however, is to be congratulated on the result of his experiments for he has succeeded in inoculating tuberculosis from birds to mammals, and conversely has shown that avian tuberculosis is transmissible to mammals. He has obtained successful results with several animals, among them rabbits, guinea-pigs and kids. Development of the disease was very slow, three to five months being usually required for the purpose. This, I believe, to be a fair estimate.

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* **See an abstract in the British Medical Journal, July 10, 1886.**

The most interesting part of Nocard's work is, that he has succeeded in cultivating the bacillus in gelatinized serum and has obtained bacilli up to an eight cultivation. His method of procedure differs slightly from that employed by Koch, in that he obtains the serum direct from the jugular vein; this renders sterilization unnecessary.

CONCLUSIONS.

A critical study of the æetiology of avian tuberculosis suggests some very important conclusions which have a great bearing on the probable source of the bacilli which infect human beings. Indeed, it is not improbable that the tubercle-bacillus may have its origin in this way. The statements of Nocard, given on the preceding page, that, in the epidemics investigated by him, the assumed cause was inoculation from the sputa of phthisical patients, will not bear the test of criticism.

All who have inquired into the lesions of tuberculosis have been struck by the myriads of bacilli present in the lesions; this is sufficient to show that the tissues of birds are especially favorable for the growth of this micro-organism. Those who have cultivated the tubercle-bacillus are unanimous in the opinion that it thrives best at a temperature varying between 37° and 39° C. The average temperature of a fowl, taken in the cloaca, is about 40° C, and this increase of temperature over the average human body-heat may explain the luxuriant growth of bacilli.

When microscopists shall have exhausted their endeavors in detecting specific differences among the infinite variety of micro-organisms, and then direct their endeavors towards the phylogeny of the various forms, they will possibly find that this remarkable bacillus, which may fitly be termed, with typhoid fever, a scourge and a bane of civilization, has been evolved from some harmless form, and that its peculiar character of thriving best at a temperature equal at least to that of the human body, was first acquired by being transplanted into a medium, the chief constituents being *animal excreta.*

I feel confident that, if due attention be directed to the disease known as "avian tuberculosis" in various parts of the world, especially with regard to its ætiology, we shall come to the conclusion that tuberculosis will stand a good chance of becoming included in that important list of diseases communicated to man from the lower animals. The list of fatal cases of tuberculosis occurring in man, appalling though it be, is small compared to the relative mortality, from this disease, among the grain-eating members of the feathered tribe.

ART. XVII.—ON INJURIES OF THE BEAK IN BIRDS, AND THE METHOD OF REPAIR.

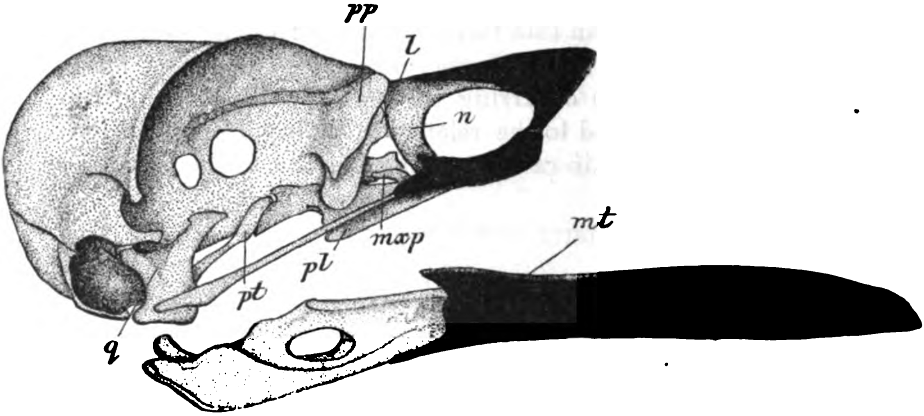
BY R. W. SHUFELDT, M. D.
Captain Medical Corps, U. S. Army.

During the month of May of the present year, while collecting about Fort Wingate, New Mexico, I often noticed among the troops of ravens (*corvus corax sinuatus*), that were to be seen at any time during the day about the gardens and slaughter house of the station, one that had evidently had his superior mandible shot away. This no doubt had been done with a rifle ball by one of the men, as they constantly fired at them with their rifles for practice. Nearly a month after I first noticed this bird, I was in need of a raven for my anatomical studies of the group, and a good opportunity offering one morning, I fired upon a number of them, killing one with each barrel, and, curious enough, upon picking up my specimens, I at once discovered that I had bagged the deformed one in question.

This bird had indeed met with a serious injury, but the natural repair was so complete and so interesting, that I prepared the skull of the individual and made the following record of the case.

I found the bird to be well nourished, though not fat, and with a beautiful suit of plumage, black and glossy.

The ball had carried away the upper bill just forward of the nostrils. This had had a notable effect upon the form of the lower mandible, for the anterior third of this part of the skull was evidently much compressed laterally, and the superior margins of the horny theca covering it, curled over towards each other and the median line. The subcylindrical channel thus formed was tightly packed with earth, no doubt rammed in there by the efforts of the bird to pick things up from the ground. I had to soak this mandible some time in water before this hard plug came away, and it is fair to presume that it caused this raven no special inconvenience, and it never made any attempt to clear it.



Right lateral view of skull of a raven (*corvus corax sinuatus*), life size from the specimen, and designed to show the method of repair following an injury to the beak. *pp*, pars plana; *l*, lacrymal; *q*, quadrate; *pt*, pterygoid; *pl*, palatine; *mxp*, maxillo-palatine; and *mt*, mandibular theca.

If we examine a normal skull of a raven, we find that the superior mandible immediately in front of the osseous nasal apertures is hollow and quite densely filled in with cancellous tissue. The side of the mandible here has an altitude of about 1 centimetre and 2 or 3 millimetres, while its base, in the roof of the mouth, measures a few millimetres more than this. Here is where the injury took place in our specimen. When the bullet cut the bill away, the anterior aspect, it will thus be seen, was of a triangular outline, and of an area agreeing with the approximate measurements we have given for the base and altitude of the parts in question.

The outer edge of this triangle, of course, was the free edge of the horny, integumental theca that overlaid the superior smandible. Now this open wound, with its firm bony walls would certainly have been a source of constant danger to this bird, had not the method nature adopted to seal it been of a very effective kind.

As it healed however, the cut edges of the osseous bill met each other in the median line, and here very perfectly, for their entire vertical distance, united completely by bony union. The stump thus formed deflected slightly to the left, while the cut anterior extremities of the palatines in the roof of the mouth, curled slightly towards each other.

When we see that the bone was thus able to so prettily close in such an ugly injury, it is not at all surprising that the horny covering followed suit. And this is just what took place, for the cut margins of this latter tissue growing to meet the occasion, it succeeded in entirely encasing the stump formed by the bone.

The result of nature's surgery in this case, then, has been a repair that practically leaves the injured part in such a condition, that it did not submit the individual to the danger of subsequent inflammations, while the form of the resulting stump is as useful a one as could possibly be expected to have followed from a wound of such a character.

Injuries of this kind in birds must be quite rare, for in a collecting experience of twenty years or more, I cannot recall a similar instance, although it is by no means an uncommon thing to find that they have sustained injuries in all other parts of the body, where too, as is well known, we find other interesting examples of the methods of repair.

ART. XVIII.—THE ROLE OF MICROBES AND THEIR CHEMICAL PRODUCTS IN THE CAUSATION OF DISEASE.

BY JAMES LAW, F. R. C. V. S.
Professor of Veterinary Science, Cornell University, N. Y.

In the present article it is not intended to demonstrate that the existence and propagation of contagious disease are due to the presence and transference of microbes or organized particles of living matter known as germs. This much may be freely accepted as absolutely demonstrated for a certain number of infectious maladies, while it is in the highest degree probable for the remainder. In the case of anthrax, chicken cholera, tuberculosis and glanders, the artificial culture of the bacterium through eight, ten or twenty successive flasks, each in succession charged with as much infecting material only as will adhere to the extreme tip of a small needle, without any appreciable loss of potency in the pathogenic quality, demonstrates a self-propagating power in a given line, which is indicative of continuous generation and life, rather than of a simple chemical change occurring in dead matter.

The Liebig theory of continuous chemical change under a given influence, as illustrated by the effect of incandescence on inflammable bodies, or of diastase on complex matter like starch, is not so acceptable as that of simple self-generation and propagation. The inflammable gas or explosive gunpowder may remain for an indefinite time in contact with the oxygen of the air without becoming incandescent. It is only when the requisite degree of heat has been generated in contact with the two, that their destructive combination is effected. With a given accession of heat this action is invariable, and once started the combustion combination goes on uninterruptedly until the whole of the inflammable material has been consumed. But it is far different with the disease virus. The temperature of a mammal is not alone sufficient to start it into action, nor is it always necessary. The virus multiplies out of the body at ordinary temperatures in different cases. The virus which is deadly to the bovine races is entirely harmless to the ovine or equine, though all alike have the same or a closely allied temperature, all take in similar food, all produce liquids and tissues closely allied in chemical composition, and capable in many cases, when once removed from the living body, of being acted on by the virus to which the animal supplying such tissue was insusceptible, and of increasing such virus indefinitely. These and other equally valid objections arise toward the diastase illustration: The conditions of life of the susceptible and insusceptible animal of a given species are the same; food, drink, ingesta, digestion, assimilation, disassimilation, secretion and excretion are the same in both so far as chemical investigation can ascertain, yet the behavior of the two in the presence of a specific virus is as different as light and darkness. A mere chemical product inducing change in another chemical material would act upon that in a corresponding manner wherever they might be brought in contact. The theory that the inability of the virus to establish its action in one case, is due to the previous abstraction from the system of some compound necessary to its action is negatived by the fact that the infusion of the tissues of that same animal body, freely sustains and increases the virulent matter. The doctrine that the exhibition is due to the deposition in the body of an insusceptible animal of some product antagonistic to such chemical action, is disproved by the same fact, as also by the further consideration that such new and antagonistic product would be inoperative if laid up in an insoluble form, and would be speedily carried out of the system by the emunctories if soluble; also that the chemical action of the virus on such preservation product must gradually use it up so that the system would once more be laid open to the attacks of the disease, whereas, as a rule, the longer the exposure of the animal system to a given disease-poison, the more perfect is its power of resistance and self-protection.

It may be assumed then that in dealing with the contagious disease, we are dealing with a germ or seed which propagates itself, like any other seed, when furnished with appropriate food under suitable conditions of life, and which becomes injurious largely in proportion to its abundance. Having reached this position, we are justified in ascribing to these living germs the essential characteristics of all living organisms.

First—There is no new creation of disease germs.—The doctrine of spontaneous generation may now be said to be definitely exploded. In every instance where organic matter has been absolutely deprived of life, by heat or otherwise, and carefully guarded against the introduction of new germs it has remained absolutely lifeless and unchanged. What occurs in the cotton-plugged sterile flask is equally true of the world at large. The fermenting wort and the rising dough convey to the mind at once the previous introduction of yeast; the waving grainfield is demonstration of the previous sowing of seed; the sight of a herd of calves carries the mind inevitably back to their sires and dams. To see a germ operating in the production of a disease therefore is to receive the assurance that that germ has had parent germs, and that when these parent germs were found under the same conditions of life, they too had produced that disease in time past. It follows that no contagious disease produced by a living germ can have arisen spontaneously and developed that germ *de novo*, and thus we are fully justified in the presence of a single case of contagious disease in making enquiry as to antecedent cases from which this has been more or less directly derived.

This does not invalidate the fact that a germ may throughout one or more generations lose much of its pathogenic potency, as in Pasteur's cultivated bacteria, or in seasons when a grave disease shows for time an unwonted originancy, yet in all such cases the direct line of generative succession is unbroken and the final cases are as surely derived from the antecedent one as if the intervening cases had been violent and fatal. A disease germ is therefore descended from other germs, and a contagious disease, from a pre-existing contagious disease.

Second—The Disease-Germ must feed.—A living organized being can only live, grow, and multiply through the appropriation of food from surrounding material. The disease-germ therefore living amongst the animal fluids must assimilate portions of these fluids to maintain its existence and propagate its kind. In this way it may impair health by abstracting from the blood and lymph materials necessary to the maintenance of the normal functions of its host; or by entering the blood-globules or tissue-nuclei and abstracting from their proper substance, elements that are essential to their integrity. The rapid appropriation of the oxygen of the animal fluids by its bacillus anthracis, has been held to be an important factor in causing the early and high mortality of anthrax, and one can easily conceive of irreparable injury through this devouring appetite of the disease-germ.

Third—The Disease-Germ must excrete.—The necessary sequence of feeding is excretion; of assimilation is disassimilation. This is no less a necessity in the lowest forms of life, than to the highest. Thus the beer yeast consumes the sugar in the malt and, after using it for its own nourishment throws out with the liquid carbonic acid and alcohol. Long since Panum drew attention to the fact that albuminous matters in a state of putrefaction developed a soluble poisonous body. Fazzie and a number of others followed in the same track and finally Selim demonstrated that a number of such poisonous *ptomaines*, were veritable organic alkaloids. Now to day we know that all such putrefactions are caused by bacteria and vibriones and that the *ptomaines* are the products of the vital processes of these minute organisms.

While the *ptomaines* of certain bacteria are deadly poisons, those of others are comparatively harmless, and hence many fungoid and bacterial organisms growing on or in the animal body are not incompatible with good health.

It follows that bacteria &c., may cause disease through the deleterious action of these secretions or excretions as well as through their abstraction from the animal fluids of materials essential to life. Practically this was demonstrated by Toussaint and Paul-Bert, who respectively filtered the virulent liquids and sterilized them by compressed oxygen, and found that the devitalized liquids administered, in large doses proved more rapidly fatal than did a moderate dose of the original virus. Moreover the sterilized liquid began its poisonous action at once, and the disease-germ, after an interval of several hours, varying according to the poison.

Here we have a clear distinction established between what may be called *bacterial infection* and *bacterial poisoning.* In the first form the living germ is implanted in the susceptible animal together with more or less of the *ptomaines* and other excretary matter. The germ goes on increasing at the expense of the animal tissues or fluids, and meanwhile throws out into the system increasing quantities of the chemical poisons, while by and by accumulate in quantity sufficient to produce a marked disturbance of the general health. In the bacterial poisoning on the other hand, whatever constitutional disorder is induced comes on at once, and if death fails to result, a steady improvement follows, for the simple *ptomaines* have no power of self-multiplication and increase, but are slowly eliminated from the body, and health is finally restored. With the *ptomaines* the effect will be exactly in ratio with the dose administered. The effects can therefore be graduated as accurately as those of any other purely chemical agent. Nor can these be the medium of the transferance of the disease to another victim. Thus with the sterilized *ptomaines* we may produce the symptoms and fatal result of an affection well known as a contagious one, yet without any power of propagating contagion or reproducing the disease in another subject.

The importance of the ptomaines in disease. It is not sought to deny the importance of the bacteria or other living germs in the causation of disease. It is conceded that they are fundamental, for without them the *ptomaines* cannot exist, while their presence in the system is directly productive of the ptomaines. Neither is it intended to depreciate the importance of accessary causes, atmospheric, electrical, telluric, climatic, hygienic, &c. All of these have their place in preparing the animal system for a defeat in the encounter with the disease-germ, and no less in acting on the germ itself in securing an increase or a decrease of its potency. It is more pertinent to our present purpose to draw especial attention to the action of the excretions of the living germ.

That the *ptomaines* are the most direct morbific agents may be deduced from various considerations:

1st. They are in many cases deadly poisons, though entirely separated from the living germs that produce them. They are therefore calculated to lay the tissues open to the destructive action of the germs themselves. Bacteria and fungi that produce no poisonous products are usually not injurious to the animal system. We find them in all exposed surfaces, in the mucous canals, and even in the superficial layers of the gastro-intestinal mucosa, yet no harm comes from their presence, they act mainly as scavengers, using up and removing dead matter which would tend to become superfluous or hurtful. In the tissues or blood of perfectly healthy animals, they are never found (Meissner).

Even when directly injected into the blood, some disease-germs perish promptly without producing either local or general disturbance. Such is the case with lung plague, and in rabbits and sheep, with rabies. In certain cases where they do attack the tissues, an unhealthy state of the tissues seems to be essential to the success of the attack. This is very noticeable in ring worm and holds no less true for a number of the bacteria. There is in short a veritable antagonism maintained between the living germ, and the living corpuscles and nuclei in the blood and tissues. When introduced in small quantity into the blood only, the contact of the few disease-germs in rapid succession with countless myriads of living blood globules places the germs at a disadvantage, and in place of destroying and assimilating the globules, they are themselves destroyed. When they do gain access to the blood and survive there, it is usually through the lymph channels in which the corpuscles are fewer and less elaborately organized, and where the flow is more tardy, so that their contest is with a relatively very small number of globules, until the bacteria have attained to great numerical force. Examples of this especial implication of the lymphatic system are seen in glanders, tuberculosis, strangles, swine-plague, anthrax, septic poisoning, &c.

In all such cases, as well as in the extension of the disease deeply from a morbid process on the surface, the role of a poisonous *ptomaine* is very potent. Exerted first on the nuclei of the tissues and the tissues themselves, it impairs or abolishes their natural functions and lays them open to chemical change. Under this lowered vitality they become an easy prey to the vigorous germ on which its own products have no such deleterious effect. Later the multiplying germs enter the lymphatic channels and similarly overcome the enfeebled lymph globules, and it is only when owing to the excessive increase of the germs that an excess of the morbid products is passed on into the blood, that the blood globules fail to hold their own, and the germ gains a status in the vital fluid.

2d. In keeping with this is the consideration that the disease-germ is a solid body and will not readily pass into the healthy solid tissues, so as to attack and impair their vitality. They may debilitate them by abstraction of oxygen and other elements, but no one can conceive of this having an equally enfeebling and destructive effect with the entrance in the untriunt fluid of the tissue of a soluble *ptomaine* endowed with the toxic power of a potent organic alkaloid. The soluble character of the *ptomaine* then is especially favorable to the establishing of its toxic action. Thus it becomes the forerunner of the germ and paves the way for its ultimate triumph.

3d. The acquired power of resisting a contagious disease, after a first attack has been endured, further sustains this doctrine of the action of the *ptomaines*. If this resistance were due to the absence of some necessary food of the bacterium, or to the presence of some substance poisonous to it, the germ would no more grow in the soup made from such tissues than in the living tissues themselves. The fact, that, it does grow in such soup, intimates that the resistance is vital and not chemical. It is difficult to understand the existence of a vital antagonism to a living organism which but assimilates its own material from the vital fluids and throws out its excreta. Much more conceivable is the acquired insusceptibility to the poisonous action of the *ptomaines*.

4th. The same doctrine is sustained by the protective action of a purely local contagious disease. As I pointed out in my report to the Department of Agriculture for 1880–1, the inoculation of lung plague in the tail, produces no active inflammation nor exudation save in the tail, yet the lungs, the normal seat of the disease, afterward resist the poison. Now if the bacteria actually reached the lungs, after the inoculation, what is to hinder the development of the local disease in this, the normal seat of its election. But taking into account that the same virus injected into the blood produces no local disease whatever, but is destroyed in the vital fluid, we are furnished, with substantial evidence that the living germ does not reach the lung at all after insertion in the tail, but perishes in the intervening blood vessels. What then reaches and protects the lungs? Manifestly the chemical products.

5th. A fifth argument in the same direction is deduced from the immunity that inheres to the fœtus, which was at an advanced stage of gestation, when its dam passed through an attack of a given contagious disease. The blood of the mother may swarm with bacteria, while that of the fœtus is entirely clear, yet the system of that fœtus is afterward as refractory to that poison as is the system of its dam. What then has entered the body of the fœtus so as to protect it? Manifestly the chemical products.

Significance of the above in relation to Prophylaxis.—It follows from the above that the chemical products may be used in self-limiting or non-recurring contagious diseases with the view of conferring immunity on the system. The debilitating poison (*ptomaines*), which paves the way for the triumph of the germ, is a simple chemical poison to which the system may become insusceptible just as the animal economy becomes by use unimpressible by alcohol, tobacco, opium, Indian hemp, arsenic, or other poison. The resistence inheres in the living tissues alone and is therefore a vital power. If therefore we can accustom the system to the chemical products of a given disease-germ, so that its nuclei will not be any longer depressed nor enfeebled by contact with such products, we place the system in a state of comparative immunity from the attacks of that germ.

As early as 1880 this was resorted to by Toussaint, who used first, filtered and then heated anthrax fluids with gratifying success, though his explanation, viz: a resulting condensation of the lymphatic glands—was an altogether untenable one. Struck with Toussaint's results, and realizing a different and more satisfactory explanation, I in the same year applied the method in swine plague, as set forth in Department of Agriculture Report for 1880–1. Since that time I have met with equal success in its application to lung plague and anthrax, but I must defer any detailed account of these to a future paper.

ART. XIX.—"BARSATI," OR ATROPHIC CARCINOMA.

BY RICHARD W. BURKE, V. S., A. V. D.
Cawnpore, India.

From 1838 to 1851 numerous essays, papers, and other contributions were published on this subject of *Barsati*, especially those which came from the pens of Army veterinarians serving at that time in India; and numerous were the theories then propounded as to its nature. It was not until 1873, however, that Spooner Hart, of Calcutta, an enthusiastic veterinarian and accurate observer, published his essay in a series of excellent papers contributed to *The Veterinarian*, far in advance of all preceding descriptions, and possessing that touch of critical appreciation which alone distinguishes a practical surgeon and clinical observer. But in recent years the opinion has been gradually coming into prominence that the clinical characteristics of disease have not the value as an element of inquiry which many would assign to them; that they are not, singly, the be-all and end-all of our pathological problems. Clinical knowledge, whether viewed as an art or a profession, should ever be agreeably associated with the other departments that are interesting in science and pleasurable in inquiry.

So much has already been written by way of contribution to our knowledge of this disease that, important as the subject is, it may be considered to have received already a fair share of attention; the pathology of it, however, cannot, perhaps, be dwelt upon too much, if we would stimulate a practical inquiry into its causation and treatment.

It is not necessary to remark that my observations led me to state as early as 1880* that this disease was cancer of the horse; and I believe no other writer has preceded me in this conclusion, so far as my knowledge of its literature has shown.

These observations refer to a few additional branches of inquiry set forth here, and I believe they may not be devoid of interest as supplying a continuation of the history of the disease; while, at the same time, it will be of some importance on account of its nomenclature and pathology, Barsati being confounded in India with many other diseases, some of which are sufficiently characteristic, while others may be said to possess only a casual resemblance to it. It is therefore necessary to have as clear a view of the disease under consideration as possible, which can only be obtained by comparing its characteristics as they occurred to various observers in separate localities, in different years and seasons, and under varied conditions of climate and treatment. Barsati flourishes in the low-lying parts of India where heat and moisture are combined. It is seldom or never heard of on the hills or in dry, elevated localities. Mr. Oliphant has recently observed that taking horses, the subject of Barsati, to the hills, brings about a speedy improvement. And the Collective Investigation Committee in England, have been lately engaged in an inquiry into the relative prevalence of human cancer, which so far establishes a similar explanation in regard to geographical and hygrometric distribution. Dr. Henry Butlin † writes, that "High and dry localities are unfavorable to the occurrence of cancer, and that the disease flourishes chiefly in low, flat parts of the country" (England), "which are covered by alluvium, and watered by many streams that are subject to frequent floods."

Dr. Walshe ‡ writes: "Certain regions of the globe are peculiarly exempt from the ravages of cancer. But is this exemption to be really referred to the special influence of climate or to some concomitant condition?" Dr. Lyford,* of America, writing on Barsati, remarks: "It seems to be confined to the neighborhood of Minneapolis and St. Paul, with the exception of a few cases, which migrate each year. Under these circumstances the question naturally arises, Why should this disease appear in two localities so far distant from each other as India and Minnesota, and under such different circumstances, and without the least sign of the disease in any of the intermediate localities?"

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*Veterinary Journal, 1880.

†Brit. Med. Journal, July 11, 1885, p. 53.

‡Treatise on Cancer, by R. Mitchell, 1879.

Jessett † says "Cancer is more ripe in *low-lying damp situations*" where cancer is more prevalent in England, such as we have found in this country, and Dr. Lyford has noted in America. Much stress has, from the first, been laid on the effects of wet weather, because it was observed that almost all the cases of Barsati were aggravated during the rains. In spite of the stress laid on this point, it was shown by the records of the late Bengal Studs that by far the largest number of cases of Barsati was actually admitted for treatment long before the commencement of the rainy season, ‡ and the months of March, April, and May are mentioned as showing the largest percentage of admissions.

A wet climate may predispose to the disease by enfeebling the animal's constitution, so that the tissues are rendered deficient in tone and nutritive functions by the sudden excess of moisture in the atmosphere, and by its direct injurious action on the local tissues, as seen in many forms of skin disease. Cutaneous disorders of a somewhat obstinate and chronic character are always found prevalent during the wet weather, from hyperaction of the skin, and which no amount of local treatment will generally remove. It has been observed that heat and moisture are favorable to the growth of vegetable fungi, which are the cause of Barsati sores becoming aggravated during the rains. If this be a sufficient explanation, how does it happen that simple sores are similarly aggravated during wet weather in India? The notion of parasitic action is contradicted positively by the fact of wet weather proving hurtful alike to Barsati as well as to all simple sores.

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*Veterinary Journal, May, 1886, pp. 379-81.

†Brit. Med. Journal, April 26, 1884.

‡The rains do not begin till the latter part of June, and end in September. The term Barsati is therefore, a misnomer.

Here, then, we perceive the opening of a most interesting and fruitful line of pathological inquiry, not yet ever seriously attempted, namely, the deleterious effects of heat and moisture upon newly injured tissues.

I have in the past brought forward facts, both clinical and pathological, to show the relationship that exists between human cancer and Barsati in all the main features. These facts, while they might serve to prove that fungi exist in sores exposed to the air, are wholly opposed to the idea that the peculiar cell changes occurring in this disease are necessarily caused by such fungi. Indeed, to imagine that fungi met with in sores once exposed to the action of the air would explain the morbid changes, must be regarded as rather sanguine. There is nothing in the history of the disease, nor in the results of its treatment, to show that its cause is likely to be parasitic. Experiments by Professor Uskoff, of Cronstadt, on dogs, show that marked necrotic changes in tissues in many cases are unattended by the appearance of organisms in even the smallest number, and have therefore led to the conclusion that the universal dependence of structural changes on parasitic organisms, maintained by some persons, is incorrect. The appearance of organisms in some cases he ascribes to the possibly imperfect removal of them from the liquids used, or to the circumstance that, by their mechanical injury to the tissues, the power of resistance was lowered, which allowed the growth of the organisms. It will thus be seen that his investigations entirely support the position maintained by several of the foremost pathologists of the day. Drs. Lewis and Cunningham, of Calcutta, have already shown how, similarly, the growth of fungi in Delhi-boil may occur as the result of the tissues being steeped in chromic acid and chromate of potash solutions. Quite recently Dr. Fenwick has found that in tissues hardened in a four per cent. solution of cocain, a peculiar mould fungus always develops, whose presence is accidental and due entirely to the process of hardening the tissue.*

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*Lancet, 1885.

Parasitic organisms frequently develop also in specimens stained in carmine solution.*

Warden and Waddell † have recently experimented with the Arbus poison. Hypodermic injections were made, mainly on cats and fowls, in order to determine whether a general parasitic condition was necessarily associated with the toxic action of the seeds. From the general results of their experiments the authors conclude that the presence of organisms at the seat of injection is purely accidental, and that these develop from the air after the injection. Professor Ponfick has demonstrated that organisms of various kinds are always present in tissues after the injection of turpentine and some other chemical irritants.‡

We cannot directly prove that parasites here precede the disease changes; indeed, all experience teaches the reverse; yet from theoretical reasoning we must conclude that such must be the case. But it seems to me that the proofs of clinical experience are of even greater consequence than any theoretical conclusions. If the parasites were the cause the disease would be communicable by inoculation. Yet, experiment has long decided in favor of the non-communicable nature of the disease. Those who favor the view that Barsati is of a parasitic origin, give us no proof in support of their view, which, to some extent, converts the morbid process into a sort of skin "sepsis" and contagious would thus differ from simple disease only in degree; since all local virulent action is absent in this disease, how can we distinguish between a simple and "infective" form of disease? May the one at any time become the other, and, if so, in obedience to what law? Those who support the "fungus" origin of Barsati leave this matter very much an open question, as indeed was unavoidable, for we do not know enough about the other varieties of this disease. It is remarkable that a series of inoculation experiments—scarifications and hypodermic and intravenous injections—conducted by myself as well as by other Veterinary-Surgeons should have been followed by no results, either local or constitutional. Indeed, judged by the verdict of common experience, the disease cannot be communicated, and is therefore not contagious.

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*Brit. Med. Journ., July 18, 1885.

† 'The Non-parasitic Nature of Arbus Poison,' by C. H. Warden and L. A. Waddell, M. B., Calcutta, 1884.

‡ Virchow's Archiv., 1881.

If the analogy of parasitic action holds good between cancer of man and Barsati in the horse, we must assume that in every instance the disease has been "caught." But experience proves this to be correct in respect of neither. Thus, Dr. Wilks says, "Cancer cannot be inoculated; it does not run a definite course; and, indeed, has no qualities which deserve it to be considered as foreign to the organism of the body," and all attempts hitherto made to communicate Barsati to healthy animals have been attended by similar failures. Neither the human nor the equine form of the disease can be inoculated. I lay stress on this point, as I find observers on both sides pointing to exceptional cases of success attending their inoculation experiments. It is possible that there may exist an actual diseased state of system not yet developed, and where by local irritation in the attempt to inoculate with the discharge a nidus may be formed for the actual development of the disease, but then only as any other local irritant. Besides, as Dr. Tilbury Fox has observed, connective-tissue corpuscles, when altered by disease, have this power of communicating disease most markedly developed.

A large number of experiments have been made by me during the last two years on horses, ponies, and dogs, with fresh matter from Barsati growths, and no results were produced. Allowing, therefore, for the sake of argument, that Mr. Smith has found a new method of injection, which produces Barsati growths in healthy animals, does this prove that the parasites he has described are the cause of Barsati growths? Do we not know of connective tissue corpuscles, as altered in disease, producing degenerative changes in the tissues, and even leading in many cases to fatal results, as shown by Virchow, Dr. Tilbury Fox, and many other good authorities? Do we not know of similar corpuscles detected by Dr. Fleming in Delhi-Boil, and which were also inocuable, producing sores in many instances indistinguishable from Delhi-sores? The production of pus-cells from pressure, of granulation-cells due to altered nutrition, &c., show that cell changes are not always connected with parasitic action, but may be independent of it. We have detected several species of bacillus, vibria, and micrococcus in the scrapings from ordinary ulcers in India.

Given the extensive changes of the skin and subcutaneous connective tissue from long-standing ulceration in Barsati, and the surgeon has no difficulty in explaining a recrudescence of disease and its return in tissues originally attacked, by a process of cell-degeneracy, independently of the existence of fungi. The teachings of Huxley, Virchow, Uskoff, and others show that the theory of susceptibility and phlogogenous action of cell upon cell is not all nonsense; it is only out of fashion, because many, at the present time, know of no "infective" process other than that by germs and fungi. Dr. Wilks writes, "It is now known that a variety of morbid growths may be produced in the tissues, and that between the one which is styled cancer and that which is identical with healthy material, all grades may exist. They are but modifications of normal tissues, show only altered nutrition, and can by no means be regarded as foreign to the system." Health and disease are in the main easily distinguishable; but as we approach the frontier, so to speak, of either condition, the power of defining between what belongs to health and what to disease, becomes more and more difficult, the one apparently leading into the other through such an insensible series of gradations that it is impossible, as Professor Huxley holds, to say at any stage of the process—Here the line between health and disease must be drawn. On this view, false growths like Barsati and other tumors, are merely abnormal developments of normal growths.

Can we infer from the casual relationship of parasites with Barsati sores, that the former are necessarily the cause of the latter? With the fact recorded in the past regarding Barsati, it behoves both scientists and practitioners to look to their diagnosis, to improve if possible our knowledge of the clinical history of the disease so that its application to pathology should become both wider and more precise, for the precision of our results in practice must depend upon the perfection of our diagnosis. If the diagnosis of so serious a disease is to be arrived at by the arbitrary adoption of a single symptom, the presence of a vegetable fungus, the marvellous success of treatment in the hands of some practitioners, as compared with others, may be explained. While fully admitting the importance of a search after parasites as an aid to diagnosis, we fancy that on this, as on many other methods of research, too exclusive dependence should not be placed, as it is probable that fungi may develop under different disease-conditions, and under more circumstances than we at present suspect. That parasites should be found in many sores in India we readily grant, but we altogether dissent from the view of their being the cause of those sores.

In the case of certain cutaneous diseases in which organisms have been found, the latter appear to have the necessary connection with the diseased conditions, but such connection is wanting in the affection here referred to, viz., Barsati. We are not among those who reject all the vegetable theories of specific morbid processes. But the evidence in favour of the parasitic origin of Barsati, as well as of some other forms of sores met with in India, is not so strong as that concerning other diseases known to depend upon the growth and action of fungi. Drs. Smith and Fleming* previously maintained that fungi were seen in Delhi-boil; and Drs. Lewis and D. D. Cunningham,† have since shown that the development of these fungi in Delhi sores was due to the methods of preparing the specimen for microscopic examination, and may be seen in *healthy* tissues hardened in special media. And if the existence of the fungus is possible and frequent apart from a Barsati sore, why, it may be asked, is it likely that it is in any way a cause of it? It would be a begging of the whole question to infer that, because certain fungi grow and develop in Barsati sores, there is, therefore, evidence of cause and effect between the fungus and Barsati sore, and that the study of the disease has become superfluous.

It appears to me incorrect, therefore, to refer this disease to parasitic action, as has hitherto been traditionally done, at least so long as we have not more definite clinical and pathological proofs than those we at present possess. Any change in the nomenclature of disease which is made without due consideration of facts of clinical medicine and pathology must surely hinder accuracy in diagnosis, and is therefore to be deprecated. Uskoff, Ponfick, Dr. Burdon Sanderson, Beale, Bennett, and others many years ago rejected an exclusively vegetable theory of morbid processes, which has not been controverted, and the idea of many normal cells capable of modification into the various forms of disease producing particles, commends itself at once as a view likely to reconcile many differences, and be acceptable to practical as well as inductive physiologists, pathologists, and clinicians.

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* Army Medical Report, 1868-69.

† Report on 'Oriental-Sore,' or Lupus Endemicus, 1876.

Paget says: "From numerous observations made during the last few years it would appear that the characteristic cancer cells and nuclei may, like the corpuscles of pus, take their rise from pre-existing cells and nuclei of the texture or organ in which the new growth originates." This mode of origin of the structural elements of cancer was first pointed out by Virchow, and he has more particularly directed attention to the changes which take place in the connective tissues during the development and growth of cancer in it. Paget writes: "For the present I will only say that I think malignant tumors are local manifestations of some specific morbid states of the blood, and that in them are incorporated peculiar morbid materials which accumulate in the blood, and which their growth may tend to increase."

The anatomical elements of cancer are now known to have no special and peculiar characteristics, and they are believed to be as easily derivable from pre-existing tissues as are other non-specific morbid growths. Most physiologists, especially on the continent of Europe, now maintain that every structure, new or old, is formed by the proliferation of the pre-existing cells. Anatomists have also done much to shake the fixedness of our methods of healing by finding evidence to show that what appear superficially different forms of morbid products are, in reality, different grades.

(To be Continued).

ART. XX.—PHENOMENA AND EVIDENCE OF SERPENT POISON.

BY G. ARCHIE STOCKWELL, M. D. F. Z. S.
Port Huron, Mich.

Great as is the scope of chemistry and the power of the microscope, there are products of Nature so exceedingly subtile and mysterious as to yet defy the most delicate and searching of tests, and to set at naught the most powerful objectives. Chief among these is the septic provision that secures to more than sixty species of serpents deadly weapons of offense and defense. It is practically, if not generically the same in all, is also common to at least one *saurian*, and exhibits modifications in none that are not with good reason, attributable to differences in habit and habitat, and influences of climate, season, size, age, development, and other ordinary phenomena of life. Drying under exposure in small scales, nearly colorless, soluble in water, partially so in glycerine and ether (the latter affording traces of fatty matter), not at all in alcohol, it manifests slight acid reaction, retains its properties for inconceivable periods, developes no special odor or taste, and is pronounced innocuous by the alimentary tract, in that it may be swallowed in any quantities and under all conditions, without affecting health or life; all the poison derived from half-a-dozen of the most venomous and virile reptiles is powerless to afflict an unfledged sparrow when poured into its open beak.

In daintiness of mechanism and service, the inoculatory apparatus of the venomous reptile transcends the more exquisite appliances of modern art. The fang teeth, typical canines, two or more in number, situate at either side of the anterior portion of the upper jaw, are independent of, and anterior to, the general dentition, which is exceeded by some five or six times in point of size and length. Lying just within the lips, rivalling the finest needles in delicate pointing, recurved, slender, and hard, they fold backward along the gums when the reptile is passive concealed by a reflection or fold of the fuccal membrane, offering no impediment to the passage of food or act of deglutition. Each is permeated in its longitudinal diameter by a capillary canal, that is but a continuation of a deep fissure at the base of the tooth where it is enfolded by the capsule of a duct communicating with the salivary apparatus, its apical outlet appearing as a minute oval fenestrum and barely traceable groove, upon its anterior or concave surface. As the tooth is falciform, and the canal direct and straight, this relation is easily understood. At the base of the fang extending from a point just beneath the nostril, back, two-thirds of the distance to the labial commissure, is found a gland, the analogue of the human *parotid*, that secretes a pure mucous saliva, but with which, oftentimes, is discovered mingled in varying proportions, a pale, straw-colored, semi-oleaginous fluid—the venom proper. The nerve and arterial supply of this gland, relatively is enormous, the former especially, and though derived through the *trigeminus*, posseses individual ganglionic relations, leading to the surmise that venom may be but a deterioration of salivary products proper under powerful nerve stimulus, rather than a secretion *sui-generis*, and this is in some measure borne out by the microscope, by its extraordinary septic properties, and by the fact its flow is powerfully stimulated either by fear or rage, and to some extent by hunger; two serpents killed under like conditions and relations of life, the one first alarmed, the other taken unawares, the former invariably reveals an undue supply of venom *within the gland*, the other little or none at all. Venom as secreted or manufactured by the gland, slowly distills away to find lodgment in the central portion of the excretory duct (*Stenonian*), that is here enlarged to form a receptacle or bulb, and from which it may be had of perfect purity in varying quantities, according to circumstances. This bulb, moreover, is surrounded by an aponeurotic capsule, the outermost and strongest layer of which is directly derived from the *masseter* muscle, through which both gland and bulb are compressed at will, emptying and refilling the latter almost synchronously.

The first flow commonly exhausts the poison fluid in the bulb; the second is less virulent in consequence of being largely dilluted with saliva; and few efforts are required to wholly exhaust the venom, when pure mucous in nocuous saliva alone results, and the creature is rendered impotent to harm. To this fortuitous circumstance may be ascribed the low rate of mortality in those bitten, as compared with the possibilities exhibited by pure venom; the virus undergoes frequent exhaustion in the effort to procure daily food.

Further examination of the mouth reveals other interesting peculiarities that, however, do not pertain to venomous tribes alone. The superior maxillary, palatine, molar, hyoid, and inferior maxillary bones, present a series of loose articulations, or more properly, perhaps, attachments, by means of elastic, expansive ligaments, whereby the oral aperture may be enormously distended and made to conform to the size and shape of the object to be received and swallowed. The teeth also, that adorn the arch of the mouth and the palate as well as the jaws, by reason of the multiple osseous sections * in which they are imbedded, are isolated and retractile in application and operation, precluding escape of prey once seized.

When the offensive or defensive is assumed by the reptile, the fangs are drawn downward in reverse plane until they point directly forward through the lips, the parotids under excitement swelling to twice or three times their natural size, producing the lateral bulging of the face so often described as flattening of the head, and all the muscles are rendered tense almost to rigidity, as the lower portion of the body is drawn into a spiral coil, upon which the remainder and the head pivots, and whereby is obtained the powerful darting movement that enables the creature to reach out in every direction to a distance of three-fifths, or four-fifths, its own length. As the head reaches the extreme limit of the spiral compatible with instantaneous recovery of position, or the point where the blow is expected to be struck, there is contemporaneous action of the compressor muscles that forces the venomous secretion violently through the apical outlets of the fangs and deep into the bottom of the wound; or, failing this the fluid is hurled to considerable distances. General Sir Arthur Conynghame relates of the Natal ombozi or spitting cobra (*naja*

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* The roof of the mouth and the palate are alike made up of articulate sections instead of being one bone.

haemachites), that one thus blinded an officer of Her Majesty's XV Regt. of Foot, at a distance of *forty-five feet* as it lay writhing in mortal agony, and that the latter did not recover his eyesight for nearly a fortnight.

With the infliction of the stroke the fangs are reversed whereby the tissues at the bottom of the wound are lacerated as if to ensure fatality—a contrivance so ingenious in its devilishness it is little wonder the Semitic races accept the serpent as the type of Supreme evil, especially as their act is neither mechanical or obligatory. Some serpents also, as the *fer de lance*, *black mamba*, and *water moccassin*, actuated by the most vindictive motives, coil and cling about the part bitten, resisting all attempts for removal, as if anxious to instill the very last drop of venom which can be produced; and I was informed by a gentleman, resident of Texas, after being bitten by a large rattlesnake, that the creature "galloped away, going with an up-and-down motion as if thrilled with pleasure," and when a place of security had been attained beneath a large rock, "lifted its head waving to-and-fro with unmistakable manifestations of delight."

On the removal of a fang, until such a time as one of the rudimentary and supernumerary canines should be developed and pushed forward to supply its place, the gland is inoperative. The production of a new fang, however, requires but a few weeks *at most*, hence I recommend those who purchase serpents under the supposition they are harmless by reason of such removal, to exercise great care and watchfulness in handling. Twice I have myself suffered from such carelessness, and have learned first to depend upon personal ocular evidence, and to secure the desired condition in the serpent by either removing rudimentary fangs or by cauterizing the lower portion of the duct thoroughly by means of needle or wire heated nearly to whiteness, when, for experimental purposes the glands may be stimulated and the virus obtained by means of a needle-pointed syringe.

The physiological manifestations of serpent venom are exceeding swift, the toxic and pathological phenomena induced no less so. It is immediately taken up by the circulatory system and conveyed to the great nerve centres, whereby rapid paralysis of those organs that derive motive power from these sources supervenes. The inoculation induces intense burning pain in the part bitten accompanied by swelling and surface discoloration—spotted with livid blotches—that may ultimately extend to a greater portion of the body; and this is followed by nausea, retching, fainting, coldness and all the evidences of collapse, that is speedily induced if relief is not obtained. A greater or less disorganization of blood takes place, not by coagulating its fibrin as is often surmised, but by attenuating, dissolving, and altering the forms of those placques and red-corpuscles, whose integrity *is life*, causing them to adhere one to another, and to the walls of their conduits. It is by this stasis of capillary circulation that œdema is indeed along with the peculiar livid flush. It is unnecessary, however, that all, or even a majority of blood-discs be destroyed, since fatality usually supervenes long before such consummation can be realized. The capilliary circulation suffers mainly, for obvious reasons, while the very size and calibre of the heart cavities and trunk arteries secure to them comparative degrees of immunity.

Of the dissolved and disorganized condition of the red-corpuscles, ample evidence is afforded by the passive hæmorrhages that are so frequently the sequel to recovery from the more immediate effects of serpent venom. Bleeding may take place from any or all of the mucous-membranes—bowels and gums more especially—from ulcerated surfaces, old scars and cicatrices, etc., defing to the utmost all styptics and hæmostatics; and the microscope will reveal not the slightest trace or indication of fibrin, the essential principle of coagulation. In a case that came under the care of the late Doctor David Brainerd of Chicago, hæmorrhage of this character was derived from the gums, and he further assured me the exhalations from the patient's body and lungs were such as to develop serious illness in attendants, so marked was the sepris! Even in dead tissue, venom procures decomposition with most extraordinary swiftness.

The myotic failure of the heart, paralysis of muscles of respiration and arrest of pulmonary circulation, reflexedly through the *par-vagum* and *great-sympathetic*, are among the earliest of physiological and pathological phenomena. Breathing becomes retarded and laborious, the lungs no longer receive their proper supply of oxygen, the blood fails to be relieved of its carbon and is returned through the arteries, doubly gorging the already poisoned capillaries of the brain; and in this we find ample cause for the train of cerebral symptoms that, commencing with drowsiness, pass rapidly into stupor, and on to profound coma, terminating in death.

With the evidence before us, to look for an "antidote" or specific is the height of folly; such is but a lingering relic of that superstition that led the ancients to seek an universal panacea, and the follies of the middle ages to dabble after the "philosopher's stone." The fate of the poisoned rests solely upon existing physiological conditions and relations—personal idiosyncrasies, habits and conditions of life and health, and the ever-varying chapters of accidents including low vitality of the serpent and non-vitality of venom—or such as may be induced. The poison and its attendant train of sequalæ follow in too swift succession to be overtaken and counteracted, even through hypodermic administration!—Moreover, the point of inoculation has no reference to the period of toxic incubation. It is possible oftentimes, however, to so assist and support nature, to tide over the period of danger until the system may rid itself of the poison. Iodine, and iodic preparations are the nearest approaches to antidotes within the scope of mortal skill, inasmuch, if quickly forced into the circulation they retard and restrain the disorganization whereby the integrity of the red-blood discs is threatened and lost, are possessed of marked antiseptic properties, and favor the production of adhesive inflammation whereby absorption is checked through the effusion and coagulation of lymph in the part bitten. But, when it is sought to discover a remedy whereby the pristine form, functions and energies of destroyed corpuscle shall be restored—which alone fulfills the indications of an *antidote*—it presupposes supernal powers whereby man can not only preserve, but *create life anew!*

Aside from the possible and problematical value of blood transfusion, the means available in serpent poisoning are: (1) The prompt arrest of circulation in the part affected and loca venesection and: (2) Enforced cardiac and pulmonary action until the emunctories shall have succeeded in eliminating the major portion of the virus. The rules laid down for the mechanical relief of opium and morphia narcosis, which present marked parallels, are of especial value, and in connection with cutaneous transpiration cannot be too highly extolled. The motto of Doctor Waring, late of H. M. E. I. service, "Enforced, continuous, violent, physical exercise, first, last and always until safety is assured!" fulfill every indication, for so long as cardaic and pulmonary action exists, death is impossible. The late Doctor Spillsbury, Surgeon General at Calcutta, relieved a favorite horse-keeper who had been bitten by a cobra (of such unusual size and virility that he was already looked upon as dead by his relatives) by fastening his hands to the back of a gig and forcing him, *willy, nilly* to keep up with the rapid motion of the horse—between nine and ten miles an hour—through a circuit of some thirty miles. In consequence, the man was rendered almost powerless through fatigue, and his body bathed by profuse perspiration, but suffered no further ill effects from the poison or the enforced exercise. The native population of India also, in spite of the popular opinion that they are familiar with antidotes for serpent venom, on the contrary are remarkably free from such superstitions, and that appears to be the especial prerogative and concomitant of advanced civilization; this I can affirm from personal knowledge and evidence, and is corroborative of the assertion that "civilization retrogrades as fast as it progresses!" The Hindoo who is so unfortunate as to encounter the cobra's fangs, is at once seized by his relatives and friends, and constant violent exercise enforced at point of stick, and severe, even cruel beatings administered. Jugglers, serpent charmers, and others who handle performing serpents, rarely deprive them of their fangs, the pecuniary success of their exhibitions depending usually upon the evidence afforded of vigor and virility on the part of their pets; they rely solely upon deftness and manual dexterity, and the well-known placidity and even temperament of the reptile, which never strikes unless alarmed or irritated, yet each and every one, realizing full well the risks to which he subjects himself, carries beneath the girdle a sharp, broad-bladed knife, whereby amputation may be instantly performed. A native of Jubalpore that I knew, had thus lost successively his left little, index, and ring fingers, and finally the hand itself.

Alcoholic stimulants are of value in so far only as they act mechanically in sustaining a sinking heart and flagging respiration, since they in no way modify the venom; and in more violent cases, they are more than useless in that they tend to prevent and retard elimination. An intoxicated person, far from enjoying the immunity his condition is supposed to secure, succumbs, if anything, more rapidly than he who has full control of his senses. A few years since, in treating of a portion of this subject, I suggested, on theoretical grounds, the employment of *annyl-nitrite*, but after practical experience therewith I am prepared to assert its danger, since its effect as a motor excitant of cardiac action is strangely transitory, is suddenly lost, when paralysis follows almost instantaneously; that it tends to favor corpuscular disintegration, I am satisfied; *ethyl iodide* answers a better purpose, and may be administered both by inhalation and by the mouth.

It is an indisputable fact that there are individuals possessed of natural or acquired idiosyncrasies whereby they are enabled to resist the influences of the most virulent serpents and, perhaps, other specific and septic poisons. It will be remembered in the "Professor's Story" by Oliver Wendell Holmes, the woman living on "Rattlesnake Hill" brought a number of those reptiles from which this elevation derived its name, in her apron, to the Assistant Master of the "Institoot" with the remark "They never touches our folks!" So, too, Col. Matthews Taylor asserts his personal knowledge of a number of persons who regarded wounds inflicted by the cobra (*naja tripudans*) and tic paloonga (*daboii Russellii*) with all the indifference ordinarily manifested to mosquito and flea bites. Again, an itinerant vendor of nostrums offered for sale on the streets of the city of Melbourne, a compound claimed as an antidote to all serpent poisons, and evidenced its efficacy by causing himself to be repeatedly bitten by a number of reptiles exhibited. A Mr. Drummond, a magistrate of the city, convinced that the fellow was an impostor, and in order to convict him as such, (believing them to be naturally inoccuous, or else deprived of their fangs,) demanded a serpent should strike him, and becoming imperative, a small tiger snake (*heplocephalus curtus*) was handed him which inflicted a wound upon his wrist. He immediately exhibited all the evidences of serpent poisoning, and in spite of the application of the much vaunted remedy, and the exertions of medical men, within an hour he was a corpse. The vendor who was arrested, acknowledged the inefficacy of his nostrum, and acknowledged he, himself, enjoyed immunity from such poisons by reason of severe inoculation received in early life, further adding he knew "some people who were born so," who had put him up to this dodge as an easy mode of livelihood.

It is commonly surmised where such immunity is congenital that it is acquired *in utero* by the inoculation of the parent, and on this turns one of the points regarding the psychical conditions manifested by Elsie Venner, in the interesting tale of Doctor Holmes, already alluded to. Whether or no such inoculation may secure immunity to offspring is a mooted, not to say doubtful question, and viewed in the light of modern investigation would seem a sequel rather to some occult or accidental physiological phenomenon. The writer and certain of his relatives, for instance, are equally proof against the sepsis of *vaccinia* and *variola*, and in one instance at least it is known that the maternal parent suffered from small-pox during pregnancy; in the others it seems to be traceable to an epidemic of kine-pox that ravaged the neighborhood where they resided, at which time many persons exhibited painful ulcers upon the hands and arms that were ascribed to that bug-bear of the mothers of the last generation, especially during the vernal season—"humors in the blood!" It is well understood also that there are analogies between most septic poisons, as venom of serpents, and poisons of contagious fevers, inasmuch as recovery from either secures a degree of immunity from subsequent attacks of the same, perhaps for life; in other words, many animal as well as pathological poisons—such as *scarlitina*, *rubeola*, *variola*, *varicella*, *pertussis*, etc., have the power of so modifying the physical economy that it is incapable of affording lodgment and nourishment to *matines morbi*, whereby like toxic evidences are induced. A familiar example is found in the fact that prolonged residence in a noted mosquito region, leads to the attacks of these pests being passed over almost unnoticed, while they entail no little suffering to new arrivals, until they in turn have been thoroughly impregnated with mosquito venom.

In connection with the supposed correlation of serpent venom and the sepsis of certain fevers, it is interesting to note that the late Dr. De Humboldt, of Havana, in a paper read before the Royal Academy of Sciences, in that city, in 1852, not only assumed their identity, but advocated the inoculation of the former as prophylactic to the latter. He had inoculated numberless persons in Cuba and Mexico with exceedingly dilute venom, thereby securing far more favorable results regarding yellow fever than has ever accrued to the Pasteurization of *rabies*, but the fact that the experiments were not pushed to definite toxic manifestations, threw a discredit upon the whole that was subsequently confirmed by De Humboldt himself through careful segregated control investigation.

That the presence of one septic ferment is in greater or less degree inimical to others, is too well known to admit of argument or disputation, but the laws thereby are far from being accurately defined or fixed. So long as the sepsis of vacinea prevails, that of variola, or of itself recurrently, is impossible. In like manner Pasteur using a simple septic poison of whose precise nature he is ignorant, and of whose relations he is an unfit judge, by a series of illy conducted experiments upon animals, presumes he is able to wield a like power upon man, which he hopes to prolong indefinitely to personal ends and aggrandizement, the more so as he is presumably cognizant that the so called virus of *rabies* has no existence save in morbid imaginations, or as developed through other septic causes. The laws of impression and coincidence would seem to be his chief reliance, and those at all familiar with the latter, especially medical men who have given time and study to control experimentation, are well aware that coincidences are much more numerous, and prevail to a much greater degree than has ever been supposed or even imagined.

MOSS ENG. CO N.Y.

THOMAS WALLEY.

ART. XXI.—THOMAS WALLEY, M. R. C. V. S.

PRINCIPAL ROYAL (DICK), VETERINARY COLLEGE, EDINBURGH.

Professor Walley, the subject of the accompanying portrait, first saw the light at Old Springs, Market Drayton, North Shropshire, England. His progenitors for several generations were distinguished agriculturists in his native country. It may be mentioned in passing that the Professor's maternal grandmother was cousin of the beautiful Sarah Hoggins, whose romantic history Tennyson has celebrated in his well-known poem "the Lord of Burleigh."

Except that his very early years were spent at the two best local schools the Professor might almost be said, as regards general attainments, to be self-educated. While still very young, he was sent, contrary to his own desire, to the establishment of a well-known merchant in Chester; but three years afterward, when at the death of his father he was allowed to follow the bent of his own inclination, he abandoned this occupation, and, having given to him the choice of two professions—medical or veterinary—he chose the latter, and was forthwith apprenticed to Mr. Bampfield Kettle, F. R. C. V. S., who was then, as now, conducting an extensive mixed practice in the County of Shropshire. Mr. Walley remained under the tuition of Mr. Kettle for more than three years, and during this period he may be said to have been thoroughly trained as a veterinary surgeon, and to have had those habits of industry, perseverance, and painstaking study, which have mainly contributed to raise him to his present prominent position in the profession. Another year was spent as assistant in the practice of Mr. Stanley, of Birmingham, and in October, 1861, he entered the Royal Veterinary College, London, as a student. During his curriculum, out of the comparatively few honors then offered to students, Mr. Walley obtained two silver medals and a certificate of honor. One of these medals was for a dissection that is still preserved in the college museum. During the latter part of his curriculum Mr. Walley acted as prosector to the late Professor Varnell, for whom he entertained a great affection.

In April, 1863, Mr. Walley obtained the diploma of the Royal College of Veterinary Surgeons, and for eight years subsequently he practiced his profession at Welshpool, West Derby, and Manchester. In 1871, Mr. Walley was appointed, after a competitive examination, to the chair of Cattle Pathology, in the Royal (Dick's) Veterinary College, Edinburgh. About a year later he was called upon to teach the additional subject of anatomy, and in 1874 he was elected to the vacant principalship of the college, which office he continues to hold at the present time. Since Professor Walley was appointed to the principalship the history of the college has been one of unbroken prosperity. The number of students has more than trebled, and at the present time, the accommodation having become quite inadequate, the college is being rebuilt on a scale that will make it the most complete and efficient for teaching purposes in Great Britain. A very large share of the labor of teaching is discharged by the Professor, who now personally conducts separate courses of tuition on Equine Pathology, Cattle Pathology, and Materia Medica Therapeutics. He occupies the honorary position of professor of Cattle Pathology to the Highland and Agricultural society, and holds appointments as veterinary inspector to the Privy Council and to the Lord Provost and Magistrates of the city of Edinburgh.

Professor Walley has been intimately and actively associated with all the recent movements having for their object the advancement of the profession. He was a Vice-President of the Council of the R. C. V. S., from 1876–79, and has been a member of the Council since 1880. During the year 1884–85, he held the office of President of the R. C. V. S., and for the current year he is President of the National Veterinary Association. He is also an honorary fellow of several British and of the Montreal V. M. Association. Professor Walley is the author of "The Veterinarian's Pocket Conspectus" (now out of print) and of "The Four Bovine Scourges," besides which he has written original articles too numerous to mention, the majority of which have been read before the various Veterinary Medical Associations, or printed in the columns of the professional journals. But the Professor's position in the veterinary profession is not to be measured by the amount of his contributions to current veterinary literature. In his capacity as Director of the Dick Veterinary College he has done excellent work in extending and perfecting the veterinary curriculum. As an instance of his influence for good in this direction we may state that he was the first to recognize the extreme importance of a practical knowledge of pathological histology to the modern veterinary student, and he was the first veterinary teacher in Great Britain to institute a regular class for the practical teaching of that most essential subject. And the effect of this advance in teaching was not confined to his own school, for that subject is now, we believe, taught with more or less thoroughness in all the other British veterinary schools. Notwithstanding the exacting nature of Professor Walley's daily duties, he finds time to read most extensively. His constant effort is to keep himself fully abreast of all improvements and discoveries in medical and veterinary science, and knowledge thus acquired is at once infused into his own teaching.

But there is another respect in which Professor Walley's position as a teacher is exercising a powerful influence for good to the veterinary profession in Great Britain. We have more than once heard the Professor's character summed up by a professional brother in the statement "Professor Walley is a gentleman," the epithet being applied in the simplest and best sense. In his intercourse with his clients, with his pupils, and with his professional brethren, Professor Walley is one who would scorn to do an action that would not bear the light of day. To his students, and to all who come into contact with him, he inculcates by precept and by example a rigid and honorable professional etiquette. Within the college walls he is a strict, but not a stern disciplinarian, and it is literally true that he is beloved by his students. Professor Walley has attained his already pre-eminent position while he is yet a comparatively young man. He is already, especially with the younger section of the profession, one of the most popular veterinarians in his native country. We sincerely trust that he may long be spared to continue the work he is doing with much honor to himself and great benefit to his profession.

ART. XXII.—U. S. ARMY VETERINARIANS.

BY JAMES A. WAUGH, V. S., 6TH CAV., U. S. A.

Much has been written deploring the low social and professional status of veterinarians employed as veterinary surgeons in the cavalry regiments of the U. S. Army. However, little or nothing has been written in favor of the subject, except some articles advocating the establishment and organization of a Veterinary Department in the U. S. Army, similar to those established and maintained by the war departments of Great Britain, France, Germany, and other European governments. Therefore it may not be amiss for an experienced army veterinarian to indulge in some remarks on the subject.

It is well known that previous to 1879 anyone was considered eligible for appointment to the position of veterinary surgeon in any of the cavalry regiments of the U. S. Army, and usually some superannuated soldier received the appointment to fill a vacancy, merely as a sinecure on account of having rendered faithful services as a family servant, or in military parlance—"a striker" or "a dog-robber." It seems the possession of a little intelligence, with some knowledge and a veterinary education, were not considered essential attainments or requisites necessary to qualify an applicant for appointment to the position of veterinary surgeon in a cavalry regiment of the U. S. Army. In 1879 Army Regulations were amended so as to read:—" Par. 287.—Appointments as Veterinary Surgeons will be confined to the graduates of established and reputable veterinary schools and colleges. They will be appointed by the Secretary of War, in numbers not to exceed the legal establishment, and only on recommendation from the commanding officer of the regiment, supported by the requisite proofs of learning and skill, and by approval of intermediate commanders." [G. O.—36,1879.]

Nevertheless it appears the above has in some cases proved a dead letter, because the non-graduates, or charlatans, empirics and quacks were retained as veterinary surgeons in the cavalry regiments of the U. S. A., and at present the best paying positions are in the hands of quacks and empirics, including the position of "Inspector of cavalry horses for the Division of the Missouri," "the latter resulting in the purchase of anatomically unsound and physically unfit animals in large numbers." Cavalry horses are usually purchased without being subjected to any qualified veterinary examination previous to purchase.

The professional duties of a veterinarian in the U. S. A. are by no means onerous or disagreeable, and he always has farriers to nurse and attend sick or disabled animals. He has plenty of leisure time to study not only his profession but other subjects as well. In some cases he is compelled to comply with special orders to visit all the stables or corrals at certain hours each day, while others are permitted to exercise their own discretion in regard to visiting the stables or corrals. They are supposed to instruct farriers and horse-shoers in regard to the proper performance of their duties, but such is usually only a matter of form. Troop commanders, farriers and horse-shoers generally manage such affairs to suit their own peculiar fancies. Veterinarians are usually stationed at regimental headquarters, and are sometimes taken out with the troops on duty in the field. They invariably move when their regiments change stations. The veterinarian is not permanently stationed at any particular post, but is occasionally ordered to other posts to treat outbreaks of disease, such as strangles, and at the same time instruct the farriers and horse-shoers. They are supposed to treat quartermasters' mules without getting any extra pay for it. Veterinarians are generally allowed to practice all they can on the outside, in private practice, among live stock owned by citizens.

The 1st, 2d, 3d, 4th, 5th and 6th regiments of U. S. cavalry are each legally entitled to one veterinary surgeon, who receives a salary of $75 a month. The 7th, 8th, 9th and 10th regiments are each legally entitled to two veterinary surgeons: one senior veterinary surgeon, who receives $100 a month, and one junior veterinary surgeon, who receives $75. Three of those senior positions are held by quacks, while the junior positions are held by regular graduates. It seems very strange that the authorities continue to foster empiricism and quackery, but decline to decently recognize regularly educated and graduated veterinarians. They get transportation and traveling expenses not to exceed four dollars per day while traveling under special orders.

There is no established or prescribed professional status for veterinary surgeons in the U. S. A., and in some garrisons they are treated as soldiers or teamsters, while at other garrisons they are treated as members of a learned profession; in short, there appears to be some diversity of opinion in the U. S. A. as to whether veterinary surgeons are professional men or common horse grooms, and of course that frequently occasions some wrangling and a little ill feeling, especially if the veterinarian is a regular graduate of some veterinary college or school. However, by a recent ruling of the Lieutenant-General, it has been decided that "veterinary surgeons are considered citizens hired to treat public animals, and in no case are they to be treated as soldiers."

Notwithstanding, one or more veterinary surgeons in the Cavalry regiments are compelled to wear the uniform of enlisted men, salute officers according to military tactics, attend "stables" and groom horses same as any cavalry soldiers do, also attend drills, and muster as if they were enlisted soldiers. In some cavalry regiments the veterinary surgeons are treated as civilians and contract surgeons, and in such cases they usually associate with the officers and their families, or with the better class of citizens and settlers on the frontier. It is very sad, though true, that some young veterinarians in the U. S. A. soon become completely discouraged, then lose self-esteem, finally acquire vicious habits, and are ultimately ruined in every respect.

Practically, the social condition of veterinarians depends entirely on their characters, manner of conduct, habits, etc. They are supposed to have the relative rank of a sergeant-major (an enlisted man), and are usually assigned to quarters in "laundress-row" along with the wives and families of soldiers. These conditions are by no means enticing or flattering to the young veterinarian in the "service of his country," but, fortunately, as a rule, he has not been "reared in the lap of luxury," and of course he only came into the army to earn some money, which will some day enable him to establish a private practice in civil life. There are occasional exceptions to the above rule, and some veterinarians enter the U. S. A., on account of indolence or intemperate habits.

There is no provision for longevity pay, retirement or pension for any veterinarian who is employed in the U. S. A., though contract surgeons employed in the U. S. A. Medical Department, are entitled to all the rights and privileges of retirements, pensions, etc., the same as regularly commissioned officers of the U. S. A.

There are five regiments of artillery in the U. S. A., but there never has been any legal provision for the employment of veterinarians for these regiments. This seems very strange, as artillery horses cost much more than cavalry horses, or even quartermasters' mules.

The veterinary profession is recognized as a learned profession by the U. S. Department of Agriculture, and by the war departments of the various civilized nations of Europe. It seems there ought to be some legislation enacted by Congress in the interest of veterinarians employed in the U. S. Army. Reputable veterinarians are not alone in entertaining the above opinion. "Calvary; Its History, Management and Uses in War," J. Roemer, L. L. D., pages 480–81, states: "In the middle ages, when the art of protecting the horse's feet was first invented, the blacksmith was horse doctor also," and in many quarters is so yet, just as in some remote rural districts the village barber is the village surgeon too, in regard to all minor operations on the human body. Veterinary surgery, which, among the ancients, was cultivated to a certain extent, was, if we except Spain, almost entirely unknown in Europe; the practice if it was left to slaves and the meanest and most ignorant farm hands. In Sweden the people looked on it as infamous; and such is the force of prejudice, that even at the present day it is still an object of contempt with many. There is no satisfactory reason, however, why the veterinarian should occupy a lower social position than any other physician. Indeed, the medical treatment of man seems less complex and less difficult of application, since it deals with only one kind of beings, endowed with the power of explaining their pains and discomforts in language; whereas among irrational animals, little can be known except from symptoms; and although the absence of moral affections and the regularity of diet greatly simplify their maladies, yet, in many cases, it is exceedingly embarrassing to determine the seat and nature of the morbid affections. But the veterinary art, after having been long despised, now begins to take rank among the most useful professions, thanks to the enlightened efforts of some governments, which have established schools for veterinary surgery, in all respects equal to other medical colleges, and similarly organized, with a regular faculty, a prescribed course, diplomas for graduates, &c. The importance of the results can hardly be overrated, if we consider how much less frequent and fatal murrain and pestilence among animals have become during the last half century; and it seems only just that men whose studies and knowledge have conferred such valuable benefits upon the community, should participate in the usual honors granted to merit. And this applies particularly to veterinary surgeons in the army, who, in most countries, still rank with non-commissioned officers, while the other surgeons, though often inferior in knowledge and skill, rank with the officers. Veterinary surgery will never fulfil the requirements of agriculture, commerce, and the army, until the profession be assimilated to that of human surgery, and until, in cavalry regiments, the veterinarian shall be no longer associated with the master tailor and boot-maker, but allowed the same privilege as officers.

EDITORIAL DEPARTMENT.

ANNOUNCEMENT.

Our readers will notice that with this number, the journal presents several important changes. The business management has been transferred to Philadelphia, and the senior editor has associated with him Dr. Huidekoper, of the Veterinary Department of the University of Pennsylvania. A systematic effort has been made to secure the co-operation of a number of well-known men, who, participating actively in the work of the JOURNAL, will represent the scientific as well as the practical aspects of comparative medicine, in the broadest sense of this term. We point with pleasure to the announcement of the staff of collaborators, on which will be found the names of the most representative men in the country in their various departments. The association of medical men with this undertaking has always been very close; it originated, indeed, in the zeal and ambition of a physician, Dr. Spitzka, who felt that the workers in comparative medicine in this country should have an organ worthy to be compared with the European journals. This continued interest of members of the medical profession is assured by the names of the distinguished men which appear on our title page.

The scope and objects of the JOURNAL will continue to be the same.

It will offer a medium for the publication of important original communications. The seven years which have elapsed since the foundation of the JOURNAL have been important ones in the history of American Veterinary Medicine. New schools have been founded, the old ones have been strengthened, and there is everywhere so much more activity displayed in the investigation of disease, that we confidently anticipate an increasing number of valuable memoirs from the laboratories and clinics of American schools. To our contributors in this department, we can promise prompt publication and a wide circulation of their articles among an interested class of readers. We shall also, from time to time, as in the present number, publish valuable communications from foreign writers. A clinical department will present summaries of interesting cases, notes on treatment and abstracts of post-mortems. We have arranged with several of the leading clinics of the country, to furnish such reports, and our columns will always be open for the reception, from any source, of short, pithy, practical notes on treatment.

In the Review department we shall give careful criticisms of recent native and foreign works, and from time to time summaries of progress in the branches of pathology, surgery and anatomy.

The editorial columns will deal with questions of scientific and general interest, as they arise, treated from an independent stand-point; and we shall make the advancement of the study and practice of comparative medicine the first consideration, to which all others shall be subsidiary. Our highest ambition is to continue the JOURNAL as the scientific organ of the veterinary profession, and we hopefully anticipate the support of all who have its interests at heart.

A bright future we believe lies before the veterinary science and art in this country. Conditions and contingencies, beyond the control of the wisest, have thwarted and hampered those who, knowing what was highest, chafed at professional life and work so far below their ideal standards; but the old order changes, and we look with pride to the rapid growth of the profession, to the attainment of a general excellence among practitioners,commensurate with the importance of their duties and to the development of a special excellence among the scientific workers, which shall give to this country a leading position in all that relates to comparative medicine.

CONTAGIOUS PLEURO-PNEUMONIA.

An eminent veterinarian stated at a public meeting a year ago, that the people of the United States would never waken up to the necessity of proper legislation for the suppression of contagious diseases among our domestic animals, until the Russian Rinderpest is imported and sweeps off two million cattle in as many months. It is to be hoped that the present outbreak of contageous pleuro-pneumonia in Chicago may prove a sufficient lesson; the lung plague is a scourge severe enough in the United States to day, without asking for more. The veterinarians of the Eastern States have appealed to the Western stock raisers to protect themselves, and individually the latter have acknowledged the importance of strong measures, but have not had the organization to compete in the political arena with the millionaire butchers of Chicago and the large cities.

A comparison of the cattle statistics of several of the infected Eastern states, with some of the important cattle states, which are threatened in the West, will show plainly the difference between them, of interest in self-protection.

In 1880* there were in

	MILCH COWS.		OXEN AND OTHER CATTLE.	
Pennsylvania	828,333		626,525	
New York	1,431,700		648,542	
New Jersey	153,700		84,500	
		2,413,733		1,359,567
Illinois	709,308		1,222,947	
Iowa	782,460		1,411,512	
Missouri	542,295		1,697,749	
		2,034,063		4,332,208

In the three Eastern States where the lung plague has been a permanent fixture for a third of a century, the milch cow exists in double numbers over the ox and other cattle; all cattle are kept in dairies or on farms with their movements among other cattle approximately controlled. The current of trade is toward these states, and the ultimate destination of nearly all these cattle is the slaughter house. In the West the milch cow and isolated cattle are but as 1 to 2, in comparison with the steers and other cattle; the animals are not individually under the eyes of the owner and constant communication is kept up among all cattle, as they pass from the hands of the breeder to those of the fattener, or in their migrations for better pasture. Contagion in the Eastern States is kept smouldering out of sight and might readily be extinguished, as it was in Massachusetts for only a little over $77,000, were it not for the penny wise policy of the state governments. Contagion in the Western states is to day an ember that a small pile of gold will smother out. Once let the blaze get beyond the dairies and distilleries of Chicago, (which resemble in principle, the condition of cattle in the Atlantic States), and the $300,000,000 worth of cattle in the West will be reduced to keep company with the cattle trade of Australia and the Cape of Good Hope.

The *Drover's Journal* of Chicago, presumably the organ of the beef exporters, has been, since the recent investigation in Chicago, maliciously puerile, in quoting the reported "pleuro-pneumonia racket," stating that the sick cattle are only suffering from ordinary pneumonia, produced by the bad hygienic surroundings of distilleries, etc.; one would suppose from some of the statements made, that Dr. Salmon and his profession had a grudge against the trade of the West. It certainly is unfortunate that many persons have a prejudice against meat of animals slaughtered by law, and are unwilling to accept the century's experience of European cities, that has demonstrated that beef from cattle which have had pleuro-pneumonia can be eaten with impunity, when inspection shows that it is free from fever or purulent taint. The history furnished us so far has been too meager to determine exactly the extent of infection in Illinois, and what may be the result of the investigations and appliance of the limited means at the disposal of the government authorities. We trust that by our next issue a definite result will have been reached, in the mean time it is the duty of all to instruct our legislators as to the only panacea of this scourge—*extermination—the pole-axe for all cattle affected with or exposed to the contagion of contagious pleuro-pneumonia, or the alternative, the ruin of the cattle trade of the West.* H.

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*The increase in the United States, of horned cattle from 1870 to 1880, was 12,000,000. Since 1880 it has probably been 20,000,000.

ELEPHANT'S BRAIN.—The brain of the elephant which was removed by Doctors Spitzka and Brill on the occasion of the slaughter of that animal at Central Park, weighed thirteen pounds and two ounces. Each cerebral hemisphere, singly, weighed four pounds and twelve ounces. The weight of the mesencephalon, with attached optic nerve origin of the pons oblongata and cerebellum (*or ambitus*) together, was three pounds and ten ounces. If we are not mistaken this is the largest brain ever weighed and the precaution has been taken to ensure correctness by weighing it twice. Dr. Spitzka was enabled to confirm on this occasion, the absence of the true pyramids in the elephant. He says "the representation in the text book of the base of the elephant's brain is a caricature. The olivary bodies are extraordinarily prominent, and they project in relief beyond the inter-olivary field, which is formed by two slender columns, parallel to each other and not apparently converging at the spinal end of the oblongata. The deep trench between the pons and olives is not filled out, as in the porpoise by a trapezium, it is therefore in the following animals alone, that the trapezium is completely hidden from view by the redundant development of the pons: man, anthropoid apes and elephant."

A detailed description of the most interesting features of the elephant's brain is promised us.

The gun shot wound which killed the animal, had fortunately injured the brain in the least important district, namely the apex of one temporal lobe (the right). The brain was extensively larcerated here in a cubic area of two inches each way, by fragments of bone which the shot had driven before it. A large hemorrhage had ensued completely injecting the arachnoid sac over the right cerebral hemisphere, the base of the brain, the epi-cerebellar space and the upper part of the spinal canal. The brain weights above given, did not therefor include the membranes which had to be separated to remove the clots. It is intimated to us, that the deep structure of the elephant's cerebral hemispheres indicate a remarkable approximation to the type of the porpoise. As is well known, the cetacea and land animals near the elephant in zoological position, agree in placentation as well as in other important points. C.

DEFECTS OF THE PRESENT U. S. ARMY VETERINARY SYSTEM. —It is to be deplored that the position of veterinary surgeon in the U. S. Army, is anything but a desirable one. Without proper rank and sufficient pay, he cannot command respect nor the obedience necessary to the carrying out of his orders and he is debarred the society of the officers. In European armies, on the contrary, he is a commissioned officer, ranking as high as colonel.

A law to regulate the matter has been drafted and submitted to Congress which, if passed, will improve the status of the veterinarians, prove a source of economy to the service and protection to army animals. C.

HOMOGLOBINURIA.—A late number of *La Clinica Veterinario*, contains an excellent article on this interesting subject and we promise our readers a translation of it in the next number of the JOURNAL.

ALKATRITS—Stearns & Co., of Detroit, have placed in the market a preparation with the above name which enables physicians or dispensers, to administer the potent alkaloids without encountering the difficulties and dangers hitherto found on account of the extremely minute doses necessary.

TO OUR READERS AND EXCHANGES.—Beginning with this number, THE JOURNAL OF COMPARATIVE MEDICINE AND SURGERY is issued from the office of Dr. A. L. Hummel, publisher, 1217 Filbert street, Philadelphia, Pa. Address all business communications to him but send exchanges and articles for publication to the editors, care of Central Park Menagerie, New York City.

CASE DEPARTMENT.

Three cases of general Sarcoma in the horse. Pathological Institute of the Royal Veterinary School in Berlin. Reported by A. Stickes, Assistant to the Professor. Translated from the manuscript by A. W. Clement, V. S.

CASE No. 1.—A hard worked horse was admitted to the hospital for what was supposed to be a severe attack of colic: death in six hours.

Autopsy. Well nourished cadaver. Abdomen much distended: rigor-mortis, strong. The abdominal cavity contained about ten quarts of dark bloody fluid. The duodenum for a short distance from the beginning of the illness infiltrated with blood, as was also the ligamentum recto-duodenalis and that part of the rectum connected with this ligament. In the region of the left kidney there was a soft dark red mass about the size of a child's head, in part covered by and in part protruding through a rupture of the peritoneum: this mass consisted of a clump of dark clotted blood mixed with the fat tissue surrounding the kidney. On the inner surface of this mass were many small tumors, varying in size from a hazelnut to that of a walnut, and of a greenish red color. The renal artery and vein were intact, and the supra-renal capsules normal. The blood-vessels supplying the fibrous capsule of the kidney were much enlarged and in many places perforated; the coagula in the neighborhood of these perforations contained broken down tumor substances. The left kidney measured 25 cm. in length and 12 cm. in width.

The tunica propria slightly thickened, and in many places projecting from the under surface were tumors about the size of a walnut, which pressed upon the substance of the kidney. The surface of the kidney was dark red in color and roughened. On section the cortex was dark red in color, but the histological character could not be made out on account of decomposition; the medullary pertion was bright red in color and the tubules were plainly visible. The right kidney measured 25 cm. in length, and 15.5 cm. in width; the surface grayish-brown in color. On section tbe cortex was seen to be yellowish-red in color; the tubules were plainly visible, the glomeoule not visible. The medullary portion was bright yellow in color, and a yellowish-white fluid could be pressed out of the papillae.

The heart was enlarged; measured from base to apex, 22 cm., left ventricle 3.5 cm. thick, right ventricle 1.5 cm. thick. The viceral surface of the pericardium was transparent, the muscle substance gray, anaemic and very fragile. The bicuspid valves considerably, the artic valves but slightly thickened. The valves of the right side of heart normal. The endocardium of the left ventricle was slightly swollen; beneath the endocardium in the musculi papillariae, the trabeculae, and on the attached borders of the bicuspid valves, many bodies, some white and some red, varying in size from a pin's head to a pea, were to be seen. In the right ventricle only hemorrhagic points were to be seen.

Histology. The swollen masses consisted of large spindle shaped cells with very little inter-cellular substance, but very vascular. The smaller nodules showed the same cellular structure.

CASE NO. 2.—A chestnut gelding presented the following external lesions. General scleroderma, multiple abscesses, and swelling of the lymph glands.

Clinical diagnosis; chronic glanders. The autopsy made a few hours after death showed the following lesions: the skin was about double its normal thickness, firmly bound to the body, and in many parts covered with a dirty gray scurvy. The subcutis, especially of the extremities presented a firm fibrous appearance ½ to 2 cm. thick, with here and there small yellow decayed masses. The lymph vessels were greatly swollen and contained a large quantity of clear amber colored fluid. The lymphatic glands, especially in the inguinal and axillary regions, were very much enlarged and on section presented a grayish-white clouded appearance. They were of firm consistence. A large quantity of clear scum was found in the articula cavities and in the sheaths of the tendons. Small aggregated masses of firm white bodies, varying in size from a pin's head to about three times that size, were found under the serosa of the stomach. Spleen much enlarged: measured 49 cm. in length and 4.5 cm. in thickness; surface, steel blue; under the capsule of the unattached portion were three, large, white, firm, nodules, in the neighborhood of which the blood-vessels were very prominent. The lymph glands of the spleen were as large as a dove's egg, firm, and when cut through seem to be infiltrated with granular whitish-gray bodies about the size of a millet seed, and very closely packed together. The liver was enlarged and firm; under the capsule were single, dispersed, coarse, white grains; in the porta hepatis these grains were closely packed together.

The lymph glands of the liver were enlarged to the size of a man's head, firm, and on section finely granular. On the peritoneal surface of the diaphragm, in the neighborhood of the columnar vertebralis, were many firm bodies the size of a millet seed. These same bodies were to be seen on the plueral surface of both lungs in the diophragmatic region. The lung parenchyma was crepitant throughout and bright red in color. The bronchial, intestinal and inferior tracheal glands were much swollen, firm, and on section, grayish white and granular. On the superior border of the trachea closely adherent to the cartilaginous rings were firm swollen masses about the size of a hazelnut, which on section showed the peripheral portion firm and rough, the centrum yellowish-white and decayed. Many milliary bodies covered the pericardium. The heart was much enlarged, weighed 9000 grams; the left verticle measured 24 cm. in length, the right ventricle 21 cm. The right auricle proper was swollen to the size of a child's head, and covered with tumors the size of a walnut, which were closely set together. Under the epicardial surface of the right auricle were many white bodies the size of a millet seed, closely crowded together and covering the entire surface of the auricle; this same condition existed on the surface of both ventricles. Under the endocardium, especially on the septal surface of the left ventricle and on the bicuspid valves, were these white millet seed sized bodies likewise to be seen, while the cavity of the right auricle was nearly filled with one mass of tumor. The nasal mucous membrane was in many parts thickened and opaque, especially in posterior part of the concha media the membrane was covered with thick muçous. Extending back from the posterior part of the concho media to the posterior nares, beneath the membrane, were many cloudy submilliary bodies. In the ductus nasalis media were many caseated milliary bodies. Small yellow masses were also to be seen in the introcostal muscles. The histology both of the larger masses and the smaller nodules was the same throughout; spindle shaped cells with fibrous intercellular substance. Chronologically arranged, perhaps the pathological changes occurred in the following way: Peritonitis, plueritis, pericarditis sarcomatosa; by metastasis the spleen muscles, myocardium, diaphragm, stomach cartilages of the trachea, and mucous membrane of the nose. Lymph-admitis sarcomatosa of the retro-peritoneal glands of the liver and spleen, the mediostival and bronchial glands. Chronic processes of the sub-cutaneous tissue, and of the lymph glands and vessels of the extremities. Rhinitis catarrahlis chronica.

Case No. 3.—The body of a ten-year-old gelding was sent to the institute with the following history: Admitted three days before with symptoms of thoracic disease; dullness on percussion over the lower third of right side of thorac; on auscultation, bronchial breathing could be heard; respirations greatly increased in frequency; death apparently from dyspnœa; diagnosis, pleuro-pneumonia-dextra.

Autopsy—The abdominal cavity contained a large quantity of dark, red fluid. The organs were in their normal position; the mucous membrane of right-half stomach was greenish-white in color, the rugae very prominent and in many places there was erosion of the epithelium. The mucous membrane of the pyloric portion was swollen, cloudy, and covered with firmly adherent mucous; the mucous membrane of the small intestine was grayish-white in color, and the follicles visible to the naked eye. The cæcum and colon were tympanitic, the mucous membrane red and in some parts greenish. The rectum was throughout its entire length, filled with faeces and distended to about the size of a man's arm except at its very commencement; at this part were two circumscribed masses, situated directly opposite each other, just beneath the serosa, causing a bulging on the outside and stenosis of the lumen.

At the end of the rectum, very near the anus, was a swollen mass 26 cm. in length, made up of tumors varying in size from a hen's egg to an apple, round and firm. The spleen weighed 1,100 grams; the capsule was a little thickened and firm in consistence; on section the trabecular were plainly visible, the pulp firm and brownish-red in color. The two kidneys weighed 2,500 grams; the capsules easily removed, the medullary substance reddened and the tubules plainly visible; the tubuli recti and tubuli contorti enlarged, cloudy and grayish-white in color; the glomeruli were injected. The liver weighed 6,500 grams; the capsule thin and soft; in the middle lobe were many calcified bodies about the size of millet seeds, and for the most part arranged in an orderly manner; the parenchyma was firm, and brownish-red in color.

Projecting from the peritoneum, covering the upper surface of the xiphoid cartilage, was a mass of tumor about the size of a child's head, which weighed 2,000 grams, lobed in appearance and lobular on section. The heart weighed 3,000 grams; no structural change. The pleural cavity contained no fluid; the pleura-costalis and pleura-diaphragmatica were covered with processes about 4 cm. long which had the appearance of mucous. On the posterior border of the right lung was a swollen mass about one-half the size of a horse's head, weighing 6,500 grams, lobular in character; each lobule seen on section to vary in size from a dove's egg to a hen's egg; there was a very considerable interlobular tissue rich in blood-vessels; these-blood vessels could be seen in places to pierce the lobules. Single lobules looked white with a yellowish shade, soft, without degeneration, about the consistence of brain matter. The blood-vessels, on leaving this mass, passed over the surface of the lung under the pleura and were distended to the size of a lead pencil, and filled with clotted blood. These vessels could be traced directly to a swollen mass in the mediastinum, which weighed 7,200 grams.

The œsophagus lay upon this swollen mass, and its walls were 1 cm. thick. The bronchial and mediaspinal lymph glands were firm and bluish-red in color; the intersticial tissue hypertrophied, the parenchyma atrophied. Both lungs were strongly retracted. On cross section glistening, dark red in color, and non crepitant, except in the anterior lobe. On microscopic examination of the mass from the rectum, one can see that the sarcoma starts from the blood-vessels, the walls of which were infiltrated with spindle cells, with oval nuclei, to such an extent as to render the normal tissue unrecognizable. The cells of the whole mass very long and arranged in bands. No intercellular tissue could be made out.

Diagnosis: Sarcoma of the rectum; metastasis to peritoneum, pleura, etc.

Conclusions. These three cases present all the same characteristics; the metastasis took place by means of the blood-vessels and not by the lymph vessels. In case No. 1 the retro peritoneal sarcoma was the primary tumor. In the greatly dilated vessels of the capsule of the kidneys the walls were found to be completely infiltrated with sarcoma cells. A piece had probably become detached and through the circulation the infectious material was carried to the right heart, then through the lung to the left ventricle and by the left coronary artery to the wall of the left ventricle, where many milliary sub endocardial tumors were to be seen. There was no affection of the lymph glands. In case No. 2 there was also no affection of the lymph glands, though there was general sarcoma throughout the abdomen and thorax. The sarcoma in the mediastinum was closely connected with that of the lung and heart, as shown by the greatly dilated condition of the blood-vessels between these parts. The mediostinal and bronchial lymph glands were *not* involved in the sarcomatous process; they showed simply hypertrophy of the introcellular tissue and atrophy of the parenchyma. In case No. 3, where the greatest extent of tumor infection was found, it is harder to draw conclusions. Yet I think that even here I make no mistake in saying that the sarcomatous infection of the lymph glands was secondary.

"It is a characteristic feature of sarcoma," says Billroth, "that the lymph glands either not at all, or very late, become affected." In this case the heart was the primary seat of infection; it weighed 9 kilograms or three times what the heart of an ordinary sized horse should weigh, while the tumors in the other organs reached only the size of hazelnuts. Later followed the infection of the lymph glands, which according to the rapidity of growth characteristic of these bodies, soon reached the size of a man's fist. The involvement of all the lymph glands of the abdomen and thorax offered a great obstacle to the circulation of the lymph, and this clearly gave rise to the hypernutrition of the skin, especially of the extremities. Finally it may be said that in all these cases there was no especial cachexia so far as external appearances could show; the subcutaneous fat tissue was normal; the hair was smooth and glistening. These cases go to establish the following conclusions, viz:

1. The secondary infection of sarcoma is carried out by means of the blood-vessels.
2. The affection of the lymph glands follows, if at all, very late.
3. General sarcomatosa progresses, contrary to the opinion formerly held, not necessarily though a special cachexia.

PROCEEDINGS VETERINARY MEDICAL SOCIETIES.

The annual meeting of the United States Veterinary Medical Association, held at the Rossmore Hotel, New York, on Tuesday, September 21st., furnished material for a great deal of reflection to all who have a sincere interest in the welfare of the Association and of the Veterinary profession at large. With the ample facilities for society meetings furnished by the Medical Societies and Veterinary Schools in New York, it seems unfortunate that a hotel should have been chosen for the assembly, and one too, where the clerk's conception of the meeting was, "that crowd who are dining."

The morning was occupied by the meeting of the Comitia Minora and the regular session was not called until an hour after the time announced. The meeting was opened by the President, Prof. L. McLean, with a short, concise address of welcome and review of his year's presidency. He called attention to Article 2, of the constitution, which defines the object of the meetings, and added a truthful criticism of the want of interest, and indifference displayed by many members of the profession. He sarcastically derided the cry that the veterinary profession needs elevation, while he regretted the fact that many members of it do. Calling attention to the numerous subjects, particularly some of the contagious diseases, which might be brought forward and discussed with advantage both to the members and to the public at large, he hoped that the future of the association would retrieve some of the neglect of the past. The reading of the minutes included those of the previous annual meeting and those of the semi-annual meeting held in Boston last March, the legality of the latter was questioned owing to the neglect of the Secretary in not giving the proper notice. The effects of this error were plainly seen in the absence of the dozen active members who usually represent Massachusetts.

The "Special Committee to secure a uniform standard of examinations by the different Veterinary Colleges of North America," furnished a report through the chairman announcing but mediocre progress, and suggesting that means be afforded the committee to visit the various schools in order to confer with the authorities personally.

While recognizing the importance of the subject, we do not believe it to be feasible. The schools are independent of government direction; some are private institutions; while others are controlled by University charters whose constitution would forbid any compact with other schools.

What is practicable is for the United States Veterinary Medical Association, the representative body of veterinarians in America, to define the *minimum* curriculum which any veterinary school must enforce in order to be recognized by the Association, and in order to render its graduates eligible to membership. This would not in any way conflict with the eligibility of the many honorable non-graduate practitioners, whose entry into the profession antedates the present opportunity for obtaining a regular education, and the admission of non-graduates should be limited to these.

The report of the committee on Diseases showed a melancholy lack of interest, which was only compensated for by an able review from the chairman, Prof. Liautard, defining the contagious diseases which need special attention, and the methods to be used in reporting them. The Prize Committee failed to make a report. The two papers which had been presented for competition (both on Parturient Apoplexy, and already published in the *American Veterinary Review*), were read by the Secretary, and by a large majority the prize was awarded to paper No. 1, which proved to be the production of Dr. T. S. Butler, of Chillicothe, Ohio.

Some twelve new members were added to the Association, and the election of officers for the ensuing year, resulted in the choice of President, Prof. A. Liautard, New York; Vice-President, Prof. William A. Zuill, Philadelphia; Secretary, Prof. C. B. Michener, New York; Treasurer, Prof. J. L. Robertson, New York. H.

NATIONAL VETERINARY MEDICAL ASSOCIATION.

The 4th annual meeting of this association met in Columbus, Ohio, on September 2d. Dr. James Hamill, of New York, President, in the chair. The Ohio State Veterinary Association attended in a body. After attending to routine business and receiving reports, Dr. Fair of Cleveland, addressed the meeting on the protection and regulation of Veterinary Medicine, by state enactments and the modes of advertising by some members of the profession.

On opening the discussion on surgical cases, some members acknowledged their inability to perform certain operations, finding fault with the colleges for not giving sufficient clinical instruction. Dr. Hamill did not agree with this view in regard to one of the operations mentioned claiming that the colleges could not procure enough material of this nature for clinics, and that no member of the profession should be ashamed that he could not perform every operation on a horse, reminding the members that the medical profession were divided into various specialties and that some times the best physician would not perform a surgical operation.

The method of teaching at the various colleges was then explained by their respective graduates, which led to a lengthy debate as to what designation or title a veterinary surgeon should receive. Dr. Hamill stated that the title or degree given by the college was the proper one. The corporate body of Great Britain, which examined for the final degree of veterinary surgeon, gave the diploma of M. R. C. V. S., but the schools had only the power to grant the degree of veterinary surgeon. The New York College of Veterinary Surgeons, was founded on the same principle as the British schools, and its charter gives it the power to grant the degree of V. S.; when the American college was organized its trustees gave the graduates the title D. V. S., Doctor of Veterinary Surgery, and when the Columbia College was started the trustees gave the same D. V. S., by reading Doctor of Veterinary Science. The election of officers for the ensuing year resulted as follows: T. Bent Cotton, V.S., Mt. Vernon, Ohio, President; Prof. R. J. Withers, Chicago Vet. College; A. J. Chandler, V. S., Michigan; T. L. Armstrong, V. S., Indiana, Vice Presidents; C. B. Robinson, V. S., Rec. Secretary; James Hamill, New York, Cor. Secretary; L. V. Plageman, M. R. C. V. S., Brooklyn; New York, Treasurer. The evening session opened by Dr. W. F. Derr, of Wooster, Ohio, reading a paper on azoturia.

THE NATIONAL VETERINARY ASSOCIATION OF GREAT BRITAIN.

The fourth annual meeting of the National Veterinary Association opened in Edinburgh, July 22, 1886. Principal Walley, of the Royal (Dick) Veterinary College, Edinburgh, presiding, and Mr. George A. Banham, Cambridge, as secretary.

The President, in his opening address, welcomed the Association to Edinburgh, which to all veterinary surgeons, he said, was classical ground, for here, upwards of a century ago, the pioneer and father of veterinary surgery was born, and upwards of seventy years ago he commenced, under disadvantageous cirumstances, to teach the practice of veterinary medicine. It was a fortunate day for the profession when Professor Dick turned his back on the London Veterinary College, and sturdily retraced his steps to Scotland and established a veterinary school of his own. Having referred to the fact that Edinburgh was the only city in the United Kingdom that was able to support more than one veterinary school, Principal Walley made a kindly allusion to the recognition given to their profession by the Highland and Agricultural Society for sixty years. After sketching the origin and progress of the National Veterinary Association, and the objects it had in view, the President briefly remarked on the immense strides made in the unification and consolidation of the profession during the last twenty years, and, in conclusion, expressed the hope that the day was not far distant when the Government would recognize the importance of the veterinary profession in the economy of the country by extending to it a helping hand. On the motion of Principal Williams—who referred to the valuable services to scientific thought of the late John Barlow—a hearty vote of thanks was given to Principal Walley for his address.

The first paper taken up for discussion was one by Mr. J. S. Hurndall, on the question—"Can experimental pathogenesy be rendered useful in elucidating a definite system of veterinary therapeutics?" The writer asserted that their therapeutics were not up to the present day practice, and called aloud for revision. The teaching of therapeutics in the schools was inadequate to fit their members for their duties, if they were to have an enlightened scientific method of administering drugs, and not a bald, empirical method. He proceeded to refer to some diseases or morbid conditions which caused the practitioner considerable anxiety, and he argued from the methods of treatment that there was urgent necessity for a revision of their therapeutics. He took as an illustration bronchitis, and recommended the administration of aconite and bryonia. Pathogenetic experimentation on animals in health was, he said, not only reasonable, but likely to prove of the highest value to the veterinary profession, provided they were carried out systematically and with the closest observation.

Mr. T. Hopkin combated the views of the essayist, and demurred to his recommendation that they should rely so largely on drugs. Without the *vis naturæ* they might throw physic to the dogs. Principal Williams said the paper had a high-sounding title, but it really amounted to nothing but homœopathy. The principle of treating disease with the view of combating the symptoms was irrational. Physiologically, aconite had the effect of soothing pain and reducing the action of the heart, but it had no specific effect on the bronchial tubes. It gave the animal repose, and they all knew that rest was the greatest factor in the cure of disease. But because they should follow the dictates of nature in the treatment of disease, he did not support the notion that disease ought to be allowed to take its course without any remedy being attempted. It was by following the dictates of nature, by the scientific application of remedies when required, by a reliance on the *vis medicatrix naturæ*, and by abandoning the "heroic measures" that appertained in his younger days, that they would become successful in their treatment. Dr. Fleming, said the better they understood physiological processes the better could they carry out pathological treatment. As a veterinary surgeon of over twenty-five years experience, he seldom gave a dose of medicine, and he had been as successful as other practitioners. He impressed upon young members of the profession that they should give less medicine, and attend more to the requirements of nature. Principal Walley said he would administer aconite in certain circumstances, but not in those recommended by the essayist. He knew from experience that they could give aconite with bicarbonate of potash or other alkaloid, providing they gave it in ball form, but if administered as a draught the chances were they would kill their subject. Mr. Hurndall replying to the discussion, said he did not understand the power of nature, but contended that nature was incapable of doing all that was required. Relying upon nature unaided was like trusting to a broken reed. He agreed that they could not cure disease, but could only assist nature, and that was what he aimed at. He regretted the introduction of the term "homœopathy." His object had been, not to sustain the principles of homœopathy, but to convince them that investigation into the action of drugs was an essential at this time. He admitted that the principle he advocated was adopted by homœopathists, but that was an entirely different matter. His practice might be a limited one, but he invariably trusted to aconite in cases of colic, and he had yet to lose his first case.

The next subject taken up was "Notes on some of the micro-parasites of the domesticated animals," by Professor M'Fadyean, of the Royal Veterinary College, and Dr. Sims Woodhead, Pathologist to the Royal Infirmary, in which they treated of splenic apoplexy, splenic fever, anthrax, quarter-evil, black-leg, glanders, swine fever, tubercle in the udders of cattle and in milk, and louping-ill. Having narrated the symptoms of the various diseases, and given a resume of the investigations by scientists, the essayists indicate the conclusions at which they have arrived. With regard to anthrax, they are of opinion–(1) That Pasteur has succeeded in preparing a vaccin by the employment of which the domestic ruminants are put in possession of a high degree of immunity against spontaneous or inoculated anthrax; (2) that by no known method of attenuation can there be obtained a vaccin of absolutely uniform strength; (3) that it is not possible to obtain a vaccin that is at once and equally applicable to all the different species of domestic animals, or even to all the different breeds of the same species; and (4) that, even in the most capable hands, accidents capable of entailing serious results may happen in the preparation of vaccin, or in its employment. Dealing with louping-ill in sheep, the writers combat at length the views of Principal Williams in which he claimed to have proved that the disease was of a micro-parasitic nature, being caused by a bacillus.

The next paper taken up was one by Professor W. O. Williams and Mr. R. Roberts on "Anæsthetics and Anæsthesia in relation to veterinary practice." Chloroform is the best general anæsthetic. For the horse, from one and a half to two ounces usually suffices to produce insensibility for a sufficient length of time to perform a short operation. For the cow, about two ounces is required; and for the dog, about one ounce. We find that to produce a short and perfect anæsthesia the less air admitted the better. In fact, we not only cause chloroform anæsthesia, but also carbonic acid anæsthesia. It takes from five to ten minutes to produce this condition, and with this method there is little or no excitement, but when the chloroform is administered with a large quantity of air there is almost always great excitement. If the animal does not recover from the narcosis in from ten to twenty minutes after the inhalation has been stopped, we apply cold water to the head and give inhalations of ammonia. Neither of us have had a single death, and we have both performed very serious and long operations. Mr. Roberts administers anæsthetics in castration, parturition in mares, cows and bitches, removal of tumors, colic and intestinal pains, and also to cause the painless death of animals.

Mr. Owen Williams administers anæsthetics in castration of cryptorchids, removal of tumors, extraction of teeth in dogs and cats, and in causing painless death in old or useless animals, and in all serious operations. As a local anæsthetic we used cocaine, varying in quantity according to the affection, and paint it on to the parts at intervals of five minutes for half an hour before operating. Mr. Owen Williams has used cocaine in painful eye affections, has relieved the pain, and been thus enabled to apply other drugs to the parts without irritating the patient; he has also used it for the removal of vaginal tumors in the bitch, and in one case the animal watched the operations without either being tied or muzzled, and showed no symptoms of pain. We do not think that the administration of chloroform or cocaine interferes at all with the healing of the surgical wounds. Principal Williams expressed the hope that they would follow the example of the medical profession, and administer anæsthetics in all possible cases where pain would be caused by the operation.

NEW JERSEY STATE VETERINARY SOCIETY.

The eighth regular meeting of this association was held at Long Branch, Thursday, August 12th, 1886. The President, Dr. Wm. B. E. Miller, of Camden, occupied the chair and called the meeting to order.

Dr. Lowe announced that he had just received a letter from Dr. Liautard, in which he said that he was obliged to excuse himself on account of an unexpected professional duty. The professor expressed regret at not being able to meet "many as former pupils, all as good workers in the profession."

Dr. Lowe also read letters from Dr. E. M. Hunt, Secretary of the New Jersey State Board of Health, Dr. F. S. Billings and others, in which they expressed a sincere desire for the welfare of the society, and regretted not being able to be present.

President Miller delivered an excellent address on Veterinary Legislation, showing how important it is that the Legislature should grant the profession still greater protection than has heretofore been accorded it by the act under which the Association is incorporated.

The members of the society had a lengthy discussion over the practice, now quite common with insurance companies, of employing their own veterinarians to look after horses that are insured by them. This method was condemned and a resolution was adopted not to treat horses that are insured in these companies, or to meet such veterinary surgeons in consultation.

The system of agricultural and other colleges having veterinary departments which are filled by but one professor, graduating young men as veterinary surgeons was generally condemned. It was the opinion of the members present that justice could not possibly be done to veterinary students at such colleges, and that it was an imposition upon the student, professor and the public in general.

The next regular meeting will be held at Trenton in December.

WM. HERBERT LOWE, D. V. S., *Secretary.*

PROGRESS OF VETERINARY SCIENCE.

PURE PEPSIN.

(Abstract from *American Analyst.*)

The United States Pharmacœpia recognizes saccharated pepsin only—this is, pepsin containing ninety per cent. of sugar of milk to every ten per cent. of actual pepsin. It will therefore, be readily seen that if a pure pepsin, that is an undiluted or concentrated pepsin, could be manufactured it would be more than ten times as strong as either the saccharated or amyl pepsin. Such has been made, and is known variously as concentrated, crystallized and scale pepsin.

Physicians when prescribing any remedy naturally desire to use that which is most reliable, even in strength, and one always to be depended upon; hence when they have once decided which preparation they will use in their prescriptions, they want to be certain that that particular preparation is the one used by the apothecary, and therefore, they should be careful to add the name of the manufacturer whose goods they wish, and not trust to the simple word "pepsin," or any of the objectives applied to it by different manufacturers, for the reason that many apothecaries will take advantage of these open doors to use the cheapest pepsin they can buy, and the result to the patient will be different from what the physician had a right to expect, greatly to his disappointment and injury to his reputation. There is no doubt that, like all good things, the best pepsin made has been imitated.

American Analyst tested twelve samples of pepsin manafactured by six different firms. All of these were obtained at drug stores, and, after being emptied into clean glass bottles, were numbered from one to twelve, and handed to two different chemists without any knowledge on their part as to the maker of any of the samples submitted. Their reports are as follows:

Number of grains of egg albumen in finely pulverized form dissolved by two grains of pepsin in six hours at a temperature 100–103° F.:

Sample No. 1	18 grains.
" " 2	19.7 "
" " 3	inert.
" " 4	"
" " 5	508 grains.
" " 6	506 "
" " 7	2018 "
" " 8	2007 "
" " 9	174 "
" " 10	336 "

It is fair to add that specimens Nos. 7 and 8 were Carl Jensen's crystal pepsin.

The largest wholesale drug house in the world, that of Gehe & Co., in Dresden, Germany, have placed the weight of their influence on the side of Jensen's by buying his product to the exclusion of every other.

PASTEURIANA.—A new form of religion has sprung up, of which Pasteur is the high priest, and in which we may say the devil is represented by the virus of rabies. The cult is taken up by young enthusiasts and middle aged men, with perfervid imaginations. They have touched the hem of Pasteur's garment, they have made the pilgrimage to Paris, they have seen the little harmless injections performed, and they are believers. Reason, facts, etc., are thrown on one side. We shall not attempt to disturb their faith, for in this connection science and faith are distinct things, and we do not argue with "Faith Healers." The latest phase of this cult is extraordinary. It is no longer a question of a sure and certain remedy for rabies. It has come down to the law of averages. Pasteur's results are better than those of any previous or contemporary hydrophobia curer—*voila tout.* Dealing with a poison or virus, which acts no one knows how, with a cultivated fluid, which also acts no one knows how, *empirical results* are all we have to depend on. This is misnamed scientific evidence. We admire the simplicity of character of these, who accept such scientific evidence, and who are so indignant at any question of doubt, etc. In *Progres Med.*, July 10th, 1886, page 586, we read, "Elvina Lagut, aged 11, was bitten at Chassagne (Jura), on 27th April last. She was brought to the laboratory of the Ecole Normale *nine days* after. During the fifteen days she passed at Paris she followed the prescribed treatment with the greatest regularity, and received the ten progressive *bouillons.* She was *declared cured* and sent back to her family. On the 13th June this child presented the first symptoms of rabies, dying on 17th June." We regret we cannot join in the chorus of satisfaction at the results obtained by M. Pasteur, in face of such results as the above. Without antagonism our stand is on the motto—

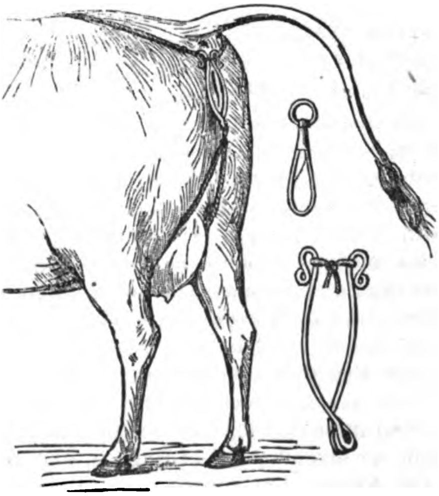
"Pax et scientia, sed veritas sine timore."

[*Provincial Med. Journal.*

HYDROPHOBIA—It has recently come to light, that the State of New York, in 1806, paid to John M. Crous a thousand dollars for a remedy against hydrophobia which he considered infallible. This measure was advocated by DeWitt Clinton and Chancellor Kent. This remedy consisted of one ounce of the jawbone of a dog, burnt and pulverized; the false tongue of a newly foaled colt, dried and pulverized; a scruple of verdigris, raised on the surface of old copper by laying it in moist earth. The warrant of the Comptroller on which the money was paid, and the receipt of Crous, are on file with other state papers at Albany.—*Science.*

A NEW CONSTRICTOR OF THE VULVA.—Of the numerous retentive bandages and ingenious belts designed for the relief of *prolapsus uteri* and *prolapsus vagina*, preference has been given to the apparatus of Delwart, with which veterinarians are now well familiar. Nevertheless, this admirable contrivance has its inconveniences. The bands enclosing the *labia majora* become easily displaced, and are difficult to graduate to the varying tumefaction, besides, they absorb the urine and become filthy, putrefaction taking place in the tissues beneath, while edema and gangrene often result. Recognizing these drawbacks, Lund devised the simple iron triangle so warmly recommended by Lanzellotti-Buonsanti, Saint Cyr and others. This also had its disadvantages, in that it did not adapt itself to the varying dimensions of the vulva, and that the upper end of the triangle projected too much or too little, according to the height of the tail.

To modify, therefore, this ingenious instrument of Lund, render it equally applicable to every size vulva, shape it to their ovoid form, make it possible to lengthen, shorten, widen, etc., when necessary, be covered with tow or have same removed without changing the cord, and render the constriction at the same time elastic and powerful without making it difficult to apply or costly in price, and without sacrificing the primitive admirable simplicity of the iron was my intention and, it appears to me, I have succeeded.



The instrument is constructed of a simple iron wire of about the thickness of a goose-quill, 70 centimeters long. The wire held firmly at the center is made to take two turns on itself, so as to make a ring about the size of the little finger. The wires on either side are then bent, forming an acute angle at the point of divergence, and the extremities folded, first outwards, then inwards on itself so as to form a figure 8. The ends converge at this point, giving the spring an ovoid shape, besides a curve is given to it so that when resting on a plane surface, it is sustained by two corresponding points of the branches working like a ship. I insist on this curvature. It greatly contributes to the easy adaptation of the instrument, and once in position to its perfect immobility. To the lower ring of the instrument a snap is fixed, and through the ring of this a cord is passed. Cords are also attached to the lateral rings.

The iron being placed on the vulvar region so that the two branches embrace the *labia majora*, the two upper cords are crossed over the lumbar region and tied, the left one to the right side of the belt and *vice versa*. The lower cords are passed one along the right inguinal region, the other along the left, and attached to the same belt a little lower down. Then a strong twine is passed through the two upper lateral rings and tied, causing the branches to approximate more or less as required. The advantage of the snap is in the facility it affords for changing the two. The materials are cheap and any blacksmith can make half a dozen of these instruments in two hours. *Eugenio Aruch V. S., in La Clinica Veterinaria.* Pisa, February, 1886.

REVIEWS.

ZUR MEDICINISCHEN STATISTIK (A contribution to medical statistics), by G. Apella, Doctor and member of several learned societies. Berlin, 1886, Published by H. S. Hermann.

This is an at once singular and interesting pamphlet, somewhat unsystematically written, but withal containing in a short space of thirty-six pages, a large number of condensed facts not generally accessible to the medical or veterinary reader. Beginning with the cardinal statement that statistics will be the foundation of the more exact medical science of the future, the author reviews all the conflicting evidences and theories that have interfered with a proper appreciation of what really is hydrophobia. One draw back about the work is that if the author has arrived at any conclusions, he has succeeded in clothing them in such ambiguous language that they are destined to remain as great a mystery to his readers as they may have been before they picked up the pamphlet. Another peculiar feature is that it is written in four languages; it opens in German, runs on for several pages in English, and winds up with an unhappy *melange* of French, Latin and German. Indeed the last page concludes with a sort of apostrophe as follows, in capitals:

DIE TOLLEN HUNDE
oder
(in des Berichtstatters Version)
DIE BANDE DER THORICHTEN HUNDE
als "Meniss, Ochka, Ochata"
(les chiens fols).

Many will doubtless draw very positive conclusions from this singular linguistic and typographical performance. But aside from his extravagances, the author has laid us under a real obligation. He has applied the foot-rule of exact evidence, to the claims of various investigators, and found the vast majority of them wanting in important qualifications essential to such work as they undertook. On the fourth page he reproduces the "Chronological Table of Outbreaks of Rabies," from the report of the Special Commission appointed by the Medical Press and Circular. To these he adds the following valuable figures of 233 persons bitten in Zurich during 42 years by alleged mad-dogs, only 4 died. Of 106 bitten during the Stockholm epidemic of 1842, only 1 required medical treatment.* In connection with these facts he refers to the suggestive claim that spontaneous hydrophobia originating from the bites of persons while infuriated *or in love*, are to be accounted for as due to trismus and tetanus. We are informed that nearly half a century ago, clear-headed logicians and surgeons, criticized and condemned the specific theory of hydrophobia. The distinguished botanist, Schleiden, inclined to regard Schomann's proposal to cure hydrophobia by extirpating a little vesicle at the base of the tongue† as a form of madness itself.

Dr. Apella says very justly: "The sufficiently uncertain diagnosis of rabies in the dog becomes altogether precarious in the cases of madness of wolves, foxes, cats, sheep, (*Moller*), horses (*Greve*), asses (*Coleius Aurelianus*), camels (*Finke*), etc., increasing in the case of the lyssa of those wounded by infuriated animals (*Galen*) * * * * * * so that it often seems madly confounded whether the animal that bit, were really mad, or the man became mad, because treated for the bite of an alleged mad dog. The remarkable apparatus of an Austrian Count,‡ devised for sufferers from lyssa, is thus described: "A cage with iron bars, a mask for the face with glasses over the eyes, muffs, soaked in oil or wax, sleeves and mantle of oil-cloth, etc.

Among the singular symptoms referred to hydrophobia, the following may interest our readers: Barking like dogs, mewing like cats, tendency to bite after being newly married, *small dogs developing in the urine.* The absurdities around the question of lyssa, recorded by recent opponents of its specific character, are supplemented by the record of an epidemic of rabies among the foxes near Frankfort in 1780, and which was traced to a pig which became *spontaneously rabid.* This is the first intimation we have received that a hog could rival hounds in a fox-hunt.

In recapitulating the various specifics against hydrophobia, the author fairly rants in justifiable sarcasm. A secret nostrum purchased for $200 from the family of Schmie de Kamp, in whose possession it had been for

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*Of 4,000 cases of bite, treated in the long history of the St. George's Hospital, "it was not known that any of these subsequently developed the disease." This experience is stated in parallelism with Youatt's observation, who failed to find a single case among 400 persons bitten by "mad dogs." They probably had implicit faith in cauterization.

†And yet this form of insanity broke forth again in the person of Marochetti, who claimed to cure lyssa by cutting out not one but several such vesicles, subsequently proven to have no existence.

‡Graf Salm-Reiffenscheid.

200 years, was composed of barley gruel.* We also learn that Dr. Lawrence had much better results than Pasteur with Sentellaria imported from New Jersey, only three deaths occurring in 850 bitten persons. Our view that typhoid fever often manifests itself under the mask of rabies in the dog, we find we have been anticipated by Kochlin, who expressed this opinion years ago. In a former number of this journal an epidemic of rabies is mentioned as occurring in Iceland, the intestines being found ulcerated and filled with a heavy material. From this "epidemic," we draw the same conclusion that Kochlin drew from his.

An interesting instance from among the numerous ones cited, of the effect of the mind on the body, is the case of the steward of Doctor Fracastoro, who died with terrible suffering before the Doctor's eyes, *because he erroneously believed he had been bitten by a tarantula.*

The predecessors of those who were attempting to quiet popular agitation in the last century, were certainly not mealy-mouthed in denouncing what they considered a humbug. Jesse Foote wrote in 1788 of the attempt of Fabroni to cure lyssa by allowing two poisonous snakes to bite the patient. "I will give my opinion of this procedure in a very few words. I regard it as the highest variety of idiocy, as a shameless insult to common sense, and a prostitution of the journal in which it was published." Dr. Apella glides gently from this subject to what he happily designates as the *coarser* forms of the same *superstition* manifested in the snake-cure. The remedies for lyssa enumerated under this head are the following "powdered ants, badger-soup, calves faeces, brain and comb of a cock, cockoo soup, carrion, blood and cleansed faeces, liver, urine, the worm from the lower vesicle of the tongue of a mad dog, flies, the liver of a male goat, horse-dung, menstrual blood (human), the tail of a shrew, *male* (! ! !), oyster-shells, the flesh of the unicorn.

As regards the management of the fully developed disease in man, some horrible records are resurrected by Apella. Thus the *Irish Times*, of May, 18, 1861, contains the account of a beautiful young woman, who was smothered to death between two pillows for rabies, in Tipperary, and the *Guardian* of April, 3, 1867, reports the daughter of one A. Woodruff, of Greenfield, Michigan, as having been disposed of in the same manner.†

Pasteur's principle, if not his exact method of curing the disease, with a "bit of hair of the dog that bit you," was anticipated by the Doctors of Finnland, who recommended the blood of the rabid animal to be drunk as a specific against the disease. This treatment can be traced back to Scandinavian sagas, just as the symptoms of traditional lyssa are referable to the "Wahrwolf's Glaube," of the middle ages.

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*These nostrums are efficacious just as long as they are kept a secret. They lose their virtue when published. The same is true of Radway's Ready Relief and Ayer's pills to this very day. In 1777 a government, not mentioned by Apella, purchased for 10,000 thalers a secret remedy of a peasant, which consisted of a powdered beetle.

† If any reader of the Journal, can furnish confirmatory or contradictory evidence regarding these or similar cases, they will confer a favor on us.

We regret that our researches anent the effect of non rabic inoculation, otherwise following Pasteur's method, were not matured before Dr. Apella's pamphlet was written. We have been unfortunate enough to produce a virus, which increasing in virulence with each inoculation, will, inserted in the brain cortex, or under the dura of the healthiest and strongest dog, produce death in coma, within twelve hours. It was obtained in the following way.

Among numerous inoculations one had been made with cancerous material from a horse's foot, cleaned and comminuted in sterilized *bouillon*. The dog died the following day in convulsions, which lasted over twelve hours. During these a large amount of saliva escaped from the animal. The floor around it was wetted with it, and the animal was literally bathed in its own discharges. Some of it was caught from the mouth several hours before death. It was tenacious and could not be filtered. This was injected in the brain of a little dog. The animal recovered rapidly from the operation, and seemed normal. But a few hours later it sank, gradually, dying during the night, a peculiar howl being noted. The brain showed no coarse lesion, but its substance had a peculiar bluish-purplish tinge near the site of the injection. The needle had just touched the cortex. The part thus discolored was comminuted, and two drops of the juice injected in the brain of a powerful coach-dog. The operation was rapidly and neatly completed. The next morning this dog was also found dead. The brain appeared disintegrated most remarkably on both sides, but mostly on the side of the injection it was mottled, purplish and blue. The ventricular lining of the lateral ventricles to the depth of two millimetres was exactly in the same condition. A large area of white brain matter, immediately underneath the injection, was converted into a chocolate-colored mass, down to the ventricle. From this brain a small part of the firm substance was treated in like manner, and injected into a third powerful dog, two hours after the former dog's death. This animal recovered in like manner from the operation, and began to sink six hours later, developing a peculiar howl, and dying about midnight, or in nine hours. A fourth dog injected with material from the second dog kept in test tubes, according to Pasteur's method for twenty-four hours, proved nearly as rapidly fatal. All the dogs showed the same symptoms; all died within twenty-four hours, and all showed the same rapid disintegration of brain substance. We have always held that the method of inoculating the brain was a faulty one, for it introduces too many complicating factors; but the rapidity with which the contamination of the brain structures progressed in our last series of cases, indicated some virulent ferment. It remains to be seen whether the hyperdermic injection be followed by the same results, a contingency we are engaged in testing as these lines go to press. S.

A MANUAL OF THE DISEASES OF THE ELEPHANT AND OF HIS MANAGEMENT AND USES. By John Henry Steel, V. S. &c., co-editor of the *Quarterly Journal of Veterinary Science in India*, Madras, 1885.

This unpretentious work comes to us from the very tropics, reminding one of several most plain unattractive looking fruits we remember, which yield in their interior a luscious morsel quite unexpected to the stranger.

Ostensibly this is a veterinary bulletin, for the use of the veterinary surgeons of the British East India Army, but as we open its pages, there appears a table of contents whose items of make up disclose an extended field of treatment, covering the national history of the Elephant; his uses at the present day in the army, though he is admitted to be "getting a little behind times" in warfare; Regulations, Instructions for his welfare in the army, as an animal of transport, Diseases of the Elephant, Medical treatment, &c., &c.

Pages IX to XXV, are devoted to an introduction consisting of a treatise on the Natural History of the Elephant, but including many items of information touching the stock owned by the Government in India. It seems that the Elephant in India, from having undergone domestication during many years has become greatly varied as a species.

Sanderson asserts, and he is regarded as the most notable authority on the subject of this great animal, that there is no evidence of decrease in numbers in India. In some places, as in Ceylon, they are not so numerous as formerly.

A number of varieties are enumerated, each valued or otherwise for certain traits or characteristic features.

An interesting summary of Temminck's conclusion concerning the Sumatran variety, by Prince Lucien Bonaparte indicates this "species" as "perfectly intermediate" between the Indian and African, especially in the shape of the skull, and will certainly put an end to the distinction between *elephas* and *loxodon* with those who admit that antomical genus—"Since" he continues, "although the crowns of the teeth of the *E. Sumatratus* are more like the Asiatic animal, still the less numerous undulated ribbons of enamel are nearly or quite as wide as those forming the lozenges of the African."

The variation in the number of ribs, and the number of the dorsal vertebrae, the sacral, and caudal vertebrae, are interesting facts, and, of course, more radical as differences than those resulting from habits of long continued domestication, whose features form the characteristics so well-known in the various presidencies and sections of India.

Saunderson enumerates a grand total of elephants belonging to the British government in India, at 1,607, besides a few males, kept for state purposes.

Some breeds of elephants have become, during the long series of years they have been under domestication, most happily fitted for certain duties, and for peculiar localities of plain or mountain. In Nepaul the breed of dwarf elephants seem to be especially desirable as adapted to mountain life and travel. Again, in the Malay peninsula there are two varieties, one north of the hilly districts of Queda are very light built, while those south of that region are much more heavily formed.

It is interesting to follow the author's numerous statements of differences. In the latter instance, the elephant is not only more heavy in build, but is more majestic, carries his head higher, and slopes more from the top of the spine to the tail root. The forehead, too, is much more prominent. Another fact is singular, and would seem to be difficult to account for. It is observed that "tuskers" are rare in Ceylon, while in India and south of Queda, in Malaya, they are the rule. Again, some are born with but one tusk. If this be the right hand one, the creature is reverenced by the Hindoos.

Races differ much in tractibility. Those of Northern India, are said to be timid, while those of Southern India are plucky and savage in attack. The females are used by government, as being more reliable, and less subject to excitement and stampede. The males are preferred by the native princes as being more imposing and majestic.

There are five plates, showing figures in outline, very artistically copied from photographs. These are especially valuable for this fact-of being directly from life. The most minute features that are visible at all, are copied correctly. The frontispiece, "Burmese Elephant Moving Beams," would naturally be looked upon as an exaggeration. The enormously large and long beam the creature is bearing off in his trunk's embrace, looks altogether out of proportion, yet the camera is true to its work; and the noble creature must be credited with wonderful power, and intelligence of the first order.

PLATE II. Exhibits two figures, one the baby suckling, and the other the same figures at rest. These have all the excellent effect of good line drawing, with the absolute accuracy of photograph.

PLATE III. Represents two figures of elephants. One is carrying the "Old Fashion Bengal Baggage Gear." The second figure shows a "Shaft Elephant of Heavy Field Battery Gun"—taken from the Artillery Manual. This shows the elephant harnessed much in the same manner as the artillery-horse, with the addition of shafts.

Mr. Sanderson's great assistance is shown in nearly all the elephant service. There are details here of many improvements introduced by him, in the methods of harnessing.

PLATE IV. Shows two figures: The first being an elephant loaded with tents and the accompanying gear; the great size of the creature, of course, enables the stowage of an entire set of such material.

The second figure of plate IV exhibits the "Gun Elephant." A 9-pounder gun is carried on one elephant, with its carriage and appointments.

Part 3d of the introduction treats of the elephant as a creature of transport. The normal load for the full-sized elephant is calculated as at 800 pounds. Compared with that of camels, the latter carry 240 pounds. That of the 'pack' mule, or bullock, is 200 pounds, The relative mobility of the elephant as a means of transport is placed high: the beasts moving on forced marches with ease, and at a rate of 3 to 3½ miles an hour, which they keep up for 10 or 12 hours at a stretch. They do with little sleep, and their limbs are especially adapted for long, slow strides, and for rest in the standing position.

Havelock, in marching to the relief of Cawnpore, depended on elephants for conveying 150 of the 5th Fusileers "*in haste*," to the place of mutiny. It is the continued, well sustained marching power of the elephant that proves so valuable in army marching and transportation.

The immense bulk of fodder required on a march is one serious drawback. The elephant requires large range if he must depend on himself for forage.

The author regards the elephant's services as an armor animal at the present day as of far less value than formerly. A serious fault is his liability to illness. He requires great care in many ways.

Part IV treats of the "Pathology of the Elephant," wherein is much interesting reading; though the elephant is not at liberty to become an element in any of our American industries, nor in army economy, this chapter or part is of less interest. The anatomy and physiology of the elephant is well treated, accompanied by some valuable cuts, and diagrams. Full tables relating to Therapeutics are introduced, as, indeed, seemingly every possible needful information relating to the welfare of the great beast. A considerable number of formulas are noticed.

An appendix presents a bibliography of the subject, and a suitable index completes this most valuable and truly interesting volume. Thoroughly valuable to the Eastern owners of elephants, and exceedingly interesting to the general reader. J. B. H.

VETERINARY SURGICAL PATHOLOGY AND PRACTICAL MEDICINE. BY JOHN BURKE AND RICHARD W. BURKE, CAWNPORE, 1886.

Our brethern in the "Far East," have always maintained a position in the front ranks of progressive workers in Veterinary Science. But the authors of the above work, have taken a step in advance, by giving the Oriental native members of the profession, the results of their labors printed in their own tongue. The illustrations are numerous and valuable, many of them being from original designs of the authors.

THE QUARTERLY JOURNAL OF VETERINARY SCIENCE IN INDIA.

We have much pleasure in calling the attention of our readers to this excellent quarterly, edited by veterinary surgeons J. H. Steel and Fred Smith, of the Army Veterinary Department. Sixteen parts have now been issued, and though it is published in India, and is chiefly devoted to animal management and veterinary practice, yet it contains much that is of great value to civil practitioners in this country. The immense territory governed by England in India affords a grand field for investigation and observation—a field which is now only beginning to be cultivated, and through no better channel, led by such able hands, could the accumulating information, coming in from every side, be concentrated, than in this periodical, which contains clinical, botanical, hygienic, and other well written papers, as well as general scientific summaries.--*Veterinary Journal.*

BOOKS AND PAMPHLETS RECEIVED.

OSTEOLOGY OF CONURUS CAROLINENSIS AND A NAVAJO SKULL. By R. W. Shufeldt, M. D., U. S. A.

JARESBERICHT DER K. CENTRAL THIERARZNIE-SCHULE IN MUNCHEN, 1884–85. Leipzig, 1886.

SECOND ANNUAL REPORT OF THE BUREAU OF ANIMAL INDUSTRY FOR THE YEAR 1885. Washington, 1886.

AMERICAN VETERINARY COLLEGE. Twelfth Annual Announcement. Session, 1885–86.

REPORT OF THE THIRD ANNUAL MEETING OF THE NATIONAL VETERINARY MEDICAL ASSOCIATION, held in Washington, December 1885.

ICHTHYOL UND RESORCIN ALS REPRASENTANTEN DER GUIPPE REDUZIERENDER HEILMITTEL VON DR. P. G. UNNA. Hamburg & Leipsig, 1886.

DETROIT COLLEGE OF MEDICINE. Announcement for session, 1886–7.

HOMOEOPATHY AS VIEWED BY A MEMBER OF THE MASSACHUSETTS MEDICAL SOCIETY. By Vincent Y. Bowditch, A. B., M. D.

ADDRESS DELIVERED BEFORE THE ALUMNI ASSOCIATION OF THE DEPARTMENT OF MEDICINE AND SURGERY OF THE UNIVERSITY OF MICHIGAN. By Charles J. Lundy, M. D. Ann Arbor, 1886.

THE MEDICAL REGISTER OF NEW YORK, NEW JERSEY AND CONNECTICUT, for the year commencing June 1, 1886. William P. White, M. D., Editor. New York, G. P. Putnam's Sons, 1886.

TYROTOXICON; its presence in poisonous ice cream; its development in milk; and its probable relation to cholera infantum and kindred diseases. By Victor C. Vaughn, M. D.

SOME RECENT EXPERIENCES IN CHEMICAL SURGERY. By Donald Maclean, M. D.

GALVANO-CAUTERY IN DISEASES OF THE PROSTATE BLADDER AND URETHRA. By Robert Newman, M. D.

SURGICAL NOTES FROM THE BOOK OF A GENERAL PRACTITIONER. By William C. Wile, M. D., Newtown, Conn.

RHEUMATOID OSTEOARTHRITIS. By Alexander Hadden, M. D., New York.

THE PAROCCIPITAL, A NEWLY RECOGNIZED FISSURAL INTEGER. By Burt G. Wilder, M. D.

STUDIES ON THE CONTAGIOUS DISEASES OF INSECTS. By S. A. Forbes—Bulletin of the Illinois State Laboratory, Art. IV., Vol. II.

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